Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/US05/008378

International filing date: 11 March 2005 (11.03.2005)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 60/552,207
Filing date: 12 March 2004 (12.03.2004)

Date of receipt at the International Bureau: 18 April 2005 (18.04.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

1306442

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

April 12, 2005

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: ***60/552,207***
FILING DATE: ***March 12, 2004***
RELATED PCT APPLICATION NUMBER: ***PCT/US05/08378***

UNITED STATES PATENT AND TRADEMARK OFFICE
DEPARTMENT OF COMMERCE

Certified by

Jon W. Dudas

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

PTO/SB/16 (08-03)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Bertram	George	Newtown, CT
Walker	Doug	Hamden, CT
Hayduk	Matthew	Glen Cove, NY

☐ *Additional inventors are being named on the _____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

DISPENSER SYSTEM

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☒ Customer Number **00441**

OR

☐ Firm *or* Individual Name					
Address					
Address					
City		State		ZIP	
Country		Telephone		Fax	

ENCLOSED APPLICATION PARTS ***(check all that apply)***

☒ Specification *Number of Pages* 32 ☐ CD(s), Number ____

☒ Drawing(s) *Number of Sheets* 46 ☐ Other (specify) ____

☐ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☒ Applicant claims small entity status. See 37 CFR 1.27.

☒ A check or money order is enclosed to cover the filing fees

☒ The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number **02-4300** **(additional fees only)**:

☐ Payment by credit card. Form PTO-2038 is attached.

FILING FEE AMOUNT ($): 80.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____.

Respectfully submitted,

SIGNATURE ________

Date 3/12/04

REGISTRATION NO. 32,936
(if appropriate)

TYPED or PRINTED NAME Dennis C. Rodgers

Docket Number: 034017R016P

TELEPHONE (202) 263-4300

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

Dispenser System

Background

The first practical hand-held dispensers for urethane-foam packaging applications are believed to have become commercially available in 1969. These designs were considered revolutionary compared to the massive, complicated, and messy urethane dispensing machinery available prior to that time.

Initially, almost all components of a dispenser were built into a single housing, which was relatively bulky compared to what is available today. This large housing incorporated the pneumatic drive cylinder, the mixing chamber with ports, the valving rod, and the solvent chamber – only the handle (with trigger) was a separate item.

The single housing dispenser was easy to service or change, but it was an expensive item, as the entire drive mechanism had to be returned for service every time a mixing chamber wore out, or an operator could not figure out how to clean a clogged chemical port.

Because of the high cost of these dispensers, return programs were set up, so that customers could return the used dispenser units to the factory for credit and refurbishment. This quickly became a logistical, and a cost accounting nightmare, but since it was believed that there was no other way to provide customer service at that time – all sorts of complicated systems and procedures were set up in an effort to make this work.

Advent of the Cartridge Gun

A subsequent technology modification was the introduction of the Cartridge Gun – by Sealed Air Corporation in 1980[1]. The cartridge was a separable item from the drive cylinder, and it incorporated the items that were most prone to failure – the chemical ports and mixing chamber. This meant that there was a lot less to discard when a failure occurred.

The cartridges were very inexpensive compared to the old style gun units, and were intended to be throwaway item. This eliminated the need for the logistical and accounting nightmare that evolved during the heyday of dispenser refurbishment, but the customer still had to purchase cartridges whenever thy became inoperable and thus was a source of expense nonetheless.

The All-Electric Dispenser

The initial cartridge oriented dispenser designs were pneumatically driven, like all of their predecessors, and required that the customer have a clean and dry supply of compressed air with a line pressure typically between 80 and 120 psi.

---

[1] Copies of a two-page time-line brochure from Sealed Air that illustrate the development timeline of the industry are attached at the end of this document.

Air-driven dispensers had some plusses:

- Simple, Easy to Understand Design
- Easy to Maintain
- Inexpensive to Manufacture

However, they also had minuses:

- Limited to locations that were able to provide compressed air to power them – this would often require the potential customer to invest in, and install a shop air compressor.
- Shop air driven power is very inefficient, some estimates put the efficiency factor at 10%. Consequently, it is very expensive to run air-powered equipment.
- These dispensers will not operate properly if shop air pressure was too low – they will be unable to generate enough force to open the cartridge.
- Even with adequate air pressure, pneumatic guns have a relatively low opening force, compared to electric drive dispensers that were developed in later years.
    - Cartridges, as they are used, develop a build-up of urethane on the ID of the mixing chamber, which gradually increases the level of force required to open the cartridge.
    - Consequently, the relatively low opening force will limit the service life of the cartridge, since it is useless if it can no longer be opened by the drive system.
- Sensitive to water in the air supply lines – which would wash the lubrication out of the sliding seals – and leak into the A chemical container from the pumps.
- Sensitive to oil and rust in the compressed air supply lines
- Although they were of simple design and easy to fix if you had the right parts, these pneumatic dispensers were not robust in the workplace, and required frequent maintenance and repair.

In or about 1989, the first all-electric systems appeared on the market, and were a big success, in large measure because they eliminated the need for shop air, and all of the associated problems and expenses. This is considered the next big advance for this technology after the invention of the cartridge concept.

Today's typical hand-held dispenser is still a cartridge based, all-electric mechanism.

To Facilitate a better understanding of the present invention there is provided a discussion of components of a hand-held, all-electric dispenser mechanism.

An electric motor driven ball screw opens and closes the valving rod in the mixing module to turn the flow of foam on and off.

Typical hand-held dispenser mechanisms have the following components:

Drive Motor – DC Brush Type - 24 to 36 volts – rare earth magnets for highest power in the smallest package – the same motor has been used in conventional hand-held dispenser applications since 1989.

Ball Screw – the heart of the dispenser - translates the rotary motion of the motor into linear motion that moves the valving rod

Gear Train – connects the motor shaft to the shaft of the ball screw

Handle – for user to hold while dispensing foam – contains the trigger switch and boot

Manifold – mounted to the handle, the manifold typically provides the mechanical backbone of the dispenser – supporting the drive system and the mixing module, and connecting to the chemical hoses that come from the pumps

Mixing Module – The component that mixes the two chemicals together to initiate the foaming process

Manifold Heater – keeps the manifold temperature close to the chemical's operating temperature to minimize the cold-shot effect – where the two chemicals do not mix well at the start of a shot because they have sat in an unheated manifold for an extended period

Trigger Switch and Boot – mounted inside the handle, the trigger starts and stops the dispensation of foam – the boot is a flexible cover designed to protect the trigger and to provide comfort for the user's finger

Small Filter Screens – mounted in the flow paths of the manifold, these removable wire mesh screens protect the orifice ports in the mixing module from particulates in the chemical

Cable Strain Relief – for the umbilical cable that connects the dispenser to the control console – prevents damage from pulling, twisting, or bending of the cable during routine use – mounted on the rear of the handle

Some Features and Benefits of a Hand-Held Dispenser Embodiment Under the Present Invention

The following is a description of some of the features and benefits of some preferred embodiments of the present invention.

A preferred embodiment of the present invention features a long, slender manifold with a narrow face. To provide for this narrow configuration, revisions were made to slenderize the manifold. For example:

- The shutoff valves were moved to the back of the dispenser. On previous conventional hand-held dispenser designs, they were placed near the front face of the manifold.
- The swivel fittings and hose connections were similarly moved farther back in comparison to previous hand-held dispenser designs.

- The diameter of the clean-out port on the face of the manifold was dramatically reduced in comparison to what has been done in many prior art dispensers for hand-held application.
- The mechanism that holds the mixing module in place on the manifold was simplified to make is quite smaller, thereby minimizing its size and mass.
- By moving the shutoff valves, swivel fittings, and hose connections to the rear of the dispenser, and minimizing the size of the port plug for the filter screen and the mechanism that holds the mixing module in place, the front of the dispenser can be made very slender under a preferred embodiment of the present invention.

The slenderization of the manifold and dispenser gun in general helps in allowing the dispenser nose to fit into smaller openings when shooting a foam-in-place pack or a molded cushion, can improve foam distribution and pack quality, makes for more efficient use of foam, and can result in a cleaner operation as one can better place the foam where it needs to be.

Moving components to the rear of dispenser also provides for a minimized size in the mechanism involved in holding the mixing module in place on the manifold in a preferred embodiment.

A preferred arrangement of the present invention also provides for placement of sensitive components away from a potential source of contamination. For example, by moving the valves, swivel fittings, and hose connections away from the mixing module area, the amount of chemical contamination to which these components are exposed is reduced.

A Chemical, B chemical, holster solvent, port cleaner spray, and foam contamination will tend to make moving parts sticky, and harder to operate, and thus the movement of sensitive dispenser components away from these potential contaminant sources helps avoid gun bind up. The avoidance of contaminant build up or sensitive or susceptible compounds avoids having components like the swivel fittings and the shutoff valves not rotate as freely which can occur if their mating surfaces are contaminated. It being further noted that the process of changing a mixing module can be a major source of contamination as solvents are used to flush the ports of the manifold clean, and thus the avoidance of such a contamination setting is beneficial. Furthermore, the dispensation of foam is another potential source of contamination due to the splattering that occurs during operation.

An arrangement under a preferred embodiment as the present invention features large area filter screening. For example, by moving the valves to the back of the manifold, and elongating the manifold, there is provided a much larger space for a filter element. The screen is preferably positioned downstream of the shutoff valve; otherwise, there can be experienced difficulty in accessing it for cleaning without opening fittings that are upstream of the valve and that could be very messy. Previous designs had relatively small filter elements because the space between the valve and the clean-out port on the face of the manifold was small. A preferred embodiment of the present invention provides a spacing that allows for a filter that is about 10 times larger in surface area than previous hand held dispenser filter elements, of similar volume output capacity.

An embodiment of the invention also provides for enhanced Ergonomic Balancing that in the Hand of the Operator. For example, by moving most of the heavy components rearward the balance of the dispenser in the user's hand is improved, as a shift in the center of gravity makes moving and handling the dispenser less stressful to the wrists and hand muscles after potentially multiple hours of usage. Even a small difference in hand balance and ease of manipulation can make a noticeable difference to an operator.

The present invention also preferably features an enhanced ball screw design having a ball screw assembly that is designed with a pitch angle of less than 11° and preferably less than 6°, as in 5.5°, as compared to previous ball screw designs that were made with a pitch angle of 11°. Preferably, under the present invention a pitch angle of about 9° or less (e.g., 9 ± .5°) is utilized. It is considered that a ball screw arrangement having a pitch angle exceeding about 9° is more susceptible to a failure mode called "free-wheeling", where the screw turns, but the nut does not advance on the screw. Thus, a larger critical angle arrangement slips instead of advancing, much like an automobile trying to climb an icy hill. If the slope or angle of the hill becomes too steep, the car spins its wheels and goes nowhere.

Prior art ball screw designs, used for urethane dispensing applications, are considered to have been designed with an 11° pitch angle, and thus are prone to this freewheeling failure mode described above. Freewheeling is indeed a leading cause of downtime for these guns.

A preferred ballscrew design of the presents invention addresses this problem with a reduction in pitch angle (including pitch angels of about 6° or less as in a 5.5° pitch angle) – which is below the noted 9° and even further below the prior art 11°).

A preferred embodiment of the present invention also preferably features a gear system that uses only two gears instead of four, as was the case in previous hand-held dispenser designs.

This reduction in the number of gears was facilitated by moving the motor to the rear of the dispenser, so that it could move closer to the centerline of the ballscrew without interference. A review of previous designs shows a positioning of the motor either above or below the ball screw, so the spacing between the centerline of the motor and the centerline of the ballscrew could not be any closer. This minimum spacing required that four gears be used to make up the gap, as it could not practically be done under those systems with only two. In a preferred embodiment of the present invention, the motor can be moved much closer to the centerline of the ballscrew, since the motor hangs off the back of the gun. Thus, there is avoided motor interference with the ball screw, and the motor can be installed in line with the ballscrew. The gear train under a preferred embodiment of the present invention provides a gear ratio, to amplify the torque of the motor. Typically, a gear ratio of below 2.5:1, as in 2:1 or 2.3:1 is representative.

A preferred embodiment of the present invention also preferably features a gear system that uses hardened steel gears that avoid service, except in the most extreme cases of abuse or vandalism. That is in contrast to the possible, but less preferred, previous gear designs using aluminum, soft stainless steel, or plastic gears, which, relative to prior art systems, presented frequent service problems in the field as they tended to have a very short service life in comparison to hardened steel. To even further avoid servicing

requirements, the present inventions gears can also be made thicker by about 50% as in .250 ± .05 inches.

The Table below illustrates some of the advantages of a preferred gear train of the present invention has over prior art designs (e.g., the Sealed Air Dispenser described above).

	IntelliPack	Representative Prior Art	Comments
Gear Material	Hardened Steel	Aluminum and/or Plastic	Hardened steel gears will outlast aluminum and plastic gears by many times
Width of Gear Face	.250 inches	.125 inches	Thicker gears last longer than thinner ones
Number of Gears	Two	Four	Fewer gears in the drive train results in a smoother running and more reliable system. Less is more when it comes to gears.
Number of Gear Shafts	Two	Three	Gears require precise spacing for greatest life span. These precision shaft spacings are much less costly to machine if you have fewer shafts to deal with.

A preferred embodiment of the present invention also features a robust trigger design as trigger switch failures represent field failure mode on previous dispenser designs. The present inventions preferred trigger assembly is designed to be sturdier than prior art designs.

A preferred design features a miniaturized mechanical switch, having a preferred 2,000,000-cycle mechanical life rating. This switch, although very reliable if treated with respect, is fragile – so a preferred embodiment of the present invention is designed with a rugged two-piece (e.g., aluminum) casing to surround it and protect it from almost any conceivable impact. This ruggedness enhancement means feature is also preferably supplemented by isolating the tiny trigger button on the microswitch by building a plunger (e.g., brass) into the casing. The plunger activates the trigger button on the switch when depressed by the trigger boot, which is deformed by the user's trigger finger. However, severe impacts to the plunger will not be transmitted to the microswitch, essentially isolating the switch from the outside world.

Figures 40 to 45 are illustrative of an embodiment of a trigger switch housing and plunger design.

Previous trigger designs were based on purchasable switch assemblies that have everything in one package, with the housing of these made of plastic.

These are fine for many intended applications, but considered not rugged enough to survive in the rough handling environment associated with a handle held dispenses during urethane dispenser.

For example, in the urethane dispenser field, trigger switches suffer from a multitude of failure modes as in impact related failures and chemical attack by, for example, the port cleaner solvent.

An embodiment of the invention features a clean-out port on the side of the manifold. For example, an embodiment of the invention features a dispenser manifold that has two extra cleanout ports, one for each chemical passageway. These cleanouts are preferably located just downstream (e.g., within one to two inches) of each shutoff valve, and aid in flushing and cleaning passageways, as in the ones that run from the valve to the mixing module.

An additional preferred embodiment of the present invention features a temperature control means as in, for example, a temperature control associated with a manifold cartridge heater, as in one built into the manifold.

For example, a cartridge heater that delivers 150 watts of power[2], suitable for heating a preferred manifold embodiment to near operating temperature in about two minutes.

Previous manifold designs either had no heater or used low powered PTC[3] type heaters.

[2] At 28 volts, DC, input power

[3] PTC stands for Positive Temperature Coefficient – and refers to a class of thermistor that has a positive temperature coefficient, which means that its resistance increases as its temperature increases. PTC's are often used as heaters because they self-limit the current flow as their resistance increases.

These PTC type heaters are designed to generate 10 to 15 watts of power, and had difficulty bringing the manifold up to operating temperature (130 to 140 deg F) because they lack sufficient power to do so.

PTC based manifold/heater combinations will typically achieve a steady-state temperature in about 20 or 30 minutes[4] – but that steady state temperature will usually be between 100 deg F and 115 deg F, which is not hot enough to eliminate a cold shot in many settings.

A preferred embodiment of the dispenser under the present invention has a closed-loop temperature control system for the manifold and its heater. An NTC type[5] of thermistor is mounted, for example, directly into the dispenser manifold, and can measure temperature with an accuracy of plus or minus 2 degrees Fahrenheit.

The thermistor of a preferred embodiment of the present invention is only used for measuring temperature, not for generating heat.

Also, previous manifold heaters were open loop, and these designs did not utilize a temperature sensor for feedback. Consequently, the manifold temperature was not controlled, and wide variations are typically observed, indeed, they are expected, depending on ambient conditions and many other factors.

The PTC heater is just allowed to run until it gets hot enough to power itself down for safety.

The following page contains a table that summarizes some differences between representative prior art manifold heater designs for dispensers found in the field (e.g., Sealed Air 800 and 900 series dispensers).

---

[4] That is considered a long time, because the rest of the system heats up in five minutes or less.

[5] NTC stands for Negative Temperature Coefficient – and refers to a class of thermistor that has a negative temperature coefficient – which means that its resistance decreases as its temperature increases. NTC's are mainly used to measure temperature – they are not considered heaters.

	Present Inventions Embodiment	Representative Prior Art	Comments
Means of Sensing Manifold Temperature	**Thermistor**	**None**	**Preferred present inventions embodiment has a sensing thermistor that is accurate to within 1 degree Fahrenheit – as compared, for example, to an open loop system with no means of monitoring or controlling temperature found in the prior art**
Means of Controlling Manifold Temperature	**Temperature Control Circuit preferably based on Thermistor Feedback**	**None**	
Accuracy of Manifold Temperature Control	**Preferably plus or minus 1 or 2 degrees Fahrenheit**	**No means of control**	**Prior arts manifold temperature is hard to predict, and is highly dependent on ambient conditions, because there is no means of control**
Heater Power	**150 Watts**	**15 Watts**	**Prior arts underpowered heater results in protracted warm-up times and is normally unable to achieve proper operating temperature – even after prolonged warm-up times**
Typical Manifold Operating Temperature	**130 degrees F**	**100 to 115 degrees F**	**A preferred embodiment of the present invention has a manifold heater that will maintain the temperature of the manifold at the same temperature setpoint as in the chemical lines – thus eliminating the cold shot phenomenon**

Typical Warm-up Time	2 minutes	Fails to achieve ideal operating temperature – will max out after 20 minutes at a suboptimal temperature	Preferred embodiment of the present invention features a manifold that warms up quickly because of provided high power and precise control circuitry.
Cold Shot	Provides for none after warm-up period is concluded	Helps to reduce the cold-shot, but does not eliminate it	Even minor cold-shot problems can degrade resultant outputs.

An additional embodiment of the present invention features a connector (e.g., electrical receptacle) on the rear of the dispensing handle. For example, in one embodiment of the invention the dispenser features nine separate wires to operate all of its electrical components, and all nine of these conductors are preferably built into one jacketed cable, which is typically called the dispenser umbilical cable. For example, it connects the dispenser, electrically, to the Base Unit of the dispenser running the full distance back to the base unit without any inline connections along the way.

By providing a receptacle on the back of the handle under a preferred embodiment, the receptacle mates with a plug on the dispenser end of the umbilical cable.

This plug in relationship is advantageous relative to the prior art, as in the aforementioned Sealed Air's 800 and 900 series dispensers.

For example, all previous electric dispenser designs used a pigtail style of connection, which can be described as follows:

There is no electrical receptacle mounted to the rear of the dispenser in the pigtail style of design. Instead, there is a plastic strain relief, mounted to the rear of the dispenser handle (in generally the same relative location as the preferred Lemo connector of the present invention's dispenser handle design).

The aforementioned strain relief is tightened securely to a length of multi-conductor cable. For instance, in the 800 series equipment noted above (as well as on the Accuflow, Flexible Products Inc., hand held product), the length of cable extending from the strain relief is about 3 feet – this is called the pigtail in the art. The prior art Sealed Air's 900 series equipment described above, the length of this pigtail cable is over 20 feet – as it runs all the way back to the wall mounted control console, while in the 800 series, the pigtail terminates with an inline electrical connector, which plugs into a mating connector on the end of the long cable that completes the run back to the wall-mounted console

This inline connection is located about three feet back from the dispenser, and creates some problems in the field by being there. Also, the aforementioned prior art electrical connection is bulky and located right where the operator will likely place his hands or his shoulder when dispensing foam. Moreover, it is not easy to secure the connector to the hose – and it tends to hang off to the side and away from the hose assembly. As a result, the threaded connections that hold the mating halves of the connectors together will

loosen – causing all sorts of intermittent electrical problems that are difficult to troubleshoot.

Sometimes, service reps or plant maintenance personnel will tightly tie-wrap the inline connector to the chemical hoses to prevent it from dangling in the way of the worker. However, this can easily over-restrain the connector assembly to the hoses, which are quite flexible and bend easily. This tight tie-in can sometimes overstress the connector, causing it to break, or become intermittent.

With regard to the very long pigtail cable, that connects the 900 series dispenser back to the wall-mount console, because of its long length, it is not so easy to remove the dispenser from the system for quick service. In addition, it is not easy to install a replacement dispenser because the full length (over 20 feet) of cable has to be managed all the way back to the console. If an operator needs to quickly replace a non-working dispenser with a new unit, or at least another functional unit, for a quick service turnaround time[6], this task is complicated by the sheer length of the cable. Even the new, replacement dispenser, will have to be shipped with the full length of cable

A preferred embodiment of the present invention has an arrangement that allows for easy and fast dispenser changeover. For instance, since the cable is not part of the dispenser, it readily disconnects right from the back of the handle (e.g., a solid cylindrical multiprong plug arrangement or a reverse female receptacle with handle male plug member).

With this arrangement there is also avoided the need for an inline connector on a pigtail – Inline connectors are prone to failure or accidental disconnection, and can get in the way of the operator.

In Addition, the above described approach of the present invention makes for a cleaner looking system as there is avoided dangling connectors and extra tie-wraps.

An additional preferred embodiment feature includes a smooth front surface of the manifold.

The migration of the large, and sensitive components (i.e., shutoff valves, swivel fittings, hose connections) to the rear of the preferred dispenser design allows the front portions of the manifold, those areas that are most likely to be contaminated by foam and solvent residue, to be made smoother, with fewer nooks and crannies. These cleaner lines will help to minimize the effort required to clean-up those areas (the mixed foam precursors have an adhesive quality making the material difficult to remove, particularly when found in nooks and crannies. Additional background discussions can be found, for example, in US Patent Application No. 10/623,100 filed July 22, 2003 which is incorporated by reference in its entirety for background purposes).

An additional embodiment or arrangement of the invention includes one having a mixing module mounting assembly and method of mounting the mixing module to the dispenser manifold, which provides for effective and yet easily servicing securement.

[6] In a high production environment, it is often prudent to simply replace the non-functional dispenser, rather than attempt to repair it on the machine. This is done to minimize downtime – to get the customer's packaging line up and running as quickly as possible. Often, the cost of downtime will far exceed the value of the dispenser. Once removed, the faulty unit can be fixed off-line at a more convenient time.

In one embodiment of the mixing module mount means of the present invention, there is provided two robust socket head cap screws to simply hold the module in place.

This design is well illustrated in the drawings at the end of this disclosure.

Some benefits of this approach include:

a) It is a very secure mounting method – both screws are unlikely to fail – and in an alternate embodiment a single screw down arrangement is featured (or greater than two although two is deemed well suited for usage in the field).

b) The two screw method is very inexpensive to manufacture

c) The two screw method is very simple – easy to understand – easy for most users to service when required

d) It is also a very robust design, unlikely to fail, as the socket screws are of the high quality, and the mixing module (which is made of aluminum, has the female threads, and is the component most likely to show wear and fatigue) is the component that gets replaced

An additional embodiment or arrangement in the present invention's mixing module design includes advantageous features in one or more of the following:

a) A **solvent chamber** inside the module housing has a high volume solvent (e.g., greater than 0.250 in^3, more preferably greater than .400 in^3 as in .474 in^3, with the latter value being considered more than four times greater in volume than comparative prior art designs).

An additional feature of the illustrated preferred embodiment is making the end of the valving rod that fits into the puller end of the ball screw much more robust than prior designs for hand-held systems.

The valving rod end on, for example, the prior art cartridge designs described herein is fragile and prone to failure. In this regard, reference is made to Ser. No. 10/623,716 filed July 22, 2003 which discusses this problem in the prior art and which is incorporated by reference.

An additional preferred feature is a mixing module cap made from hardened steel at the face of the module. That is, the face of a preferred embodiment of a hand-held mixing module is made from a material that is hard, and abrasion resistant as in the hardened steel (Rc 58) is resistant to scratching, wear, and abrasion caused by, for example, stainless steel bristles of the brush in the solvent holster (a holder that is either user supported or attached to a nearby station holder).

The solvent brush bristles in such holders are often made from Stainless Steel, which is significantly softer than the hard steel of the cap. Consequently, the bristles will not damage the face of the mixing module (i.e., the cap has a greater hardness than bristle brush steel).

A preferred embodiment also features a hood cover or cowling feature on the rear end of the mixing module which protects sensitive areas from chemical, foam, and solvent contamination.

- The area behind the mixing module is exposed to foam spatter, A-chemical, B-chemical, holster solvent, and port cleaner solvent.
- These contaminants, through various mechanisms, cause service problems with the dispenser mechanism
- The ball screw is particularly sensitive to contamination – and the area behind the mixing module is a potential pathway for this contamination to enter into the ball screw.
- In addition, the valving rod puller at the end of the ball screw can become clogged with these chemicals, making it difficult to remove or install the mixing module.

The integrated hood provides means for protecting this sensitive area from contamination – in an efficient and easy to install manner.

An additional feature of the preferred embodiment of the present invention is ease in disassembling for service based on, for example, one or more of the following attributes:

a) Removable Handle – four screws

b) Removable Motor Cover – two screws

c) Removable Front Cover – two screws

d) The Drive Train Separates from the Chemical Manifold (four screws) so there is no need to break into any chemical lines to replace a malfunctioning drive unit. This minimizes downtime in what can offer to be a critical operational situation.

A still further feature of a preferred embodiment of the present invention is the providing of chemical line swivel fittings which are less prone to chemical leakage than previous designs.

For example, the prior art single bearing design approach, used in the 900 series swivel, is considered to be not very rigid in the bearing support. That is, the single bearing design is considered not well suited to prevent, large or even slight wobbles between the inner and outer swivel housings.

This wobble can work the o-ring seals, deforming them in a manner that they were not intended to withstand, causing them to leak slightly. This lack of rigidity in the previously used swivels led to increased leakage and premature seal failure.

One arrangement under the present invention features a double ball bearing arrangement (pair of caged ball bearing sets), instead of only one, between the inner and outer swivel housings. This helps eliminate wobble, and greatly improves the life of the seals.

In addition, the swivel of the preferred embodiment employs a double o-ring seal. Previous designs like those described above are deemed to have relied on only one.

Also, a preferred design is able to incorporate the double seals, and the double bearings, in a package only slightly bigger than prior art designs, that have only single bearings and single seals.

A preferred embodiment of the present invention, also features an arrangement wherein the tip of the heater wire is located as to avoid blocking the flow of chemical through the swivel fitting. For example, heater wires on hand-held systems generally extend all the way to the dispenser end of the chemical hose[7]. Because of this, the tip of the heater wire has the potential to block chemical flow by means of its tip end getting lodged into whatever fitting that the tip extends into.

- The function of the heater wire tip is to ease the passage of the heater wire through the ID of the chemical hose, which is not smooth, but convoluted.
- The convolutions greatly improve the flexibility and kink-resistance of the chemical hose, but tend to catch of sharp edges or protrusions on anything that has to slide through the hose ID.
- To avoid this problem, there is installed in the present invention a Teflon insert, with a bullet nose shape extending forward, on the leading edge of the heater wire assembly (reference being made for the previously incorporated application for further background).
- This Teflon insert helps the tip of the heater wire to slide over the convolutions.

However, if the heater wire is longer than the chemical hose, this tip will lodge itself in the fittings that the hose is connected to, on the dispenser end.

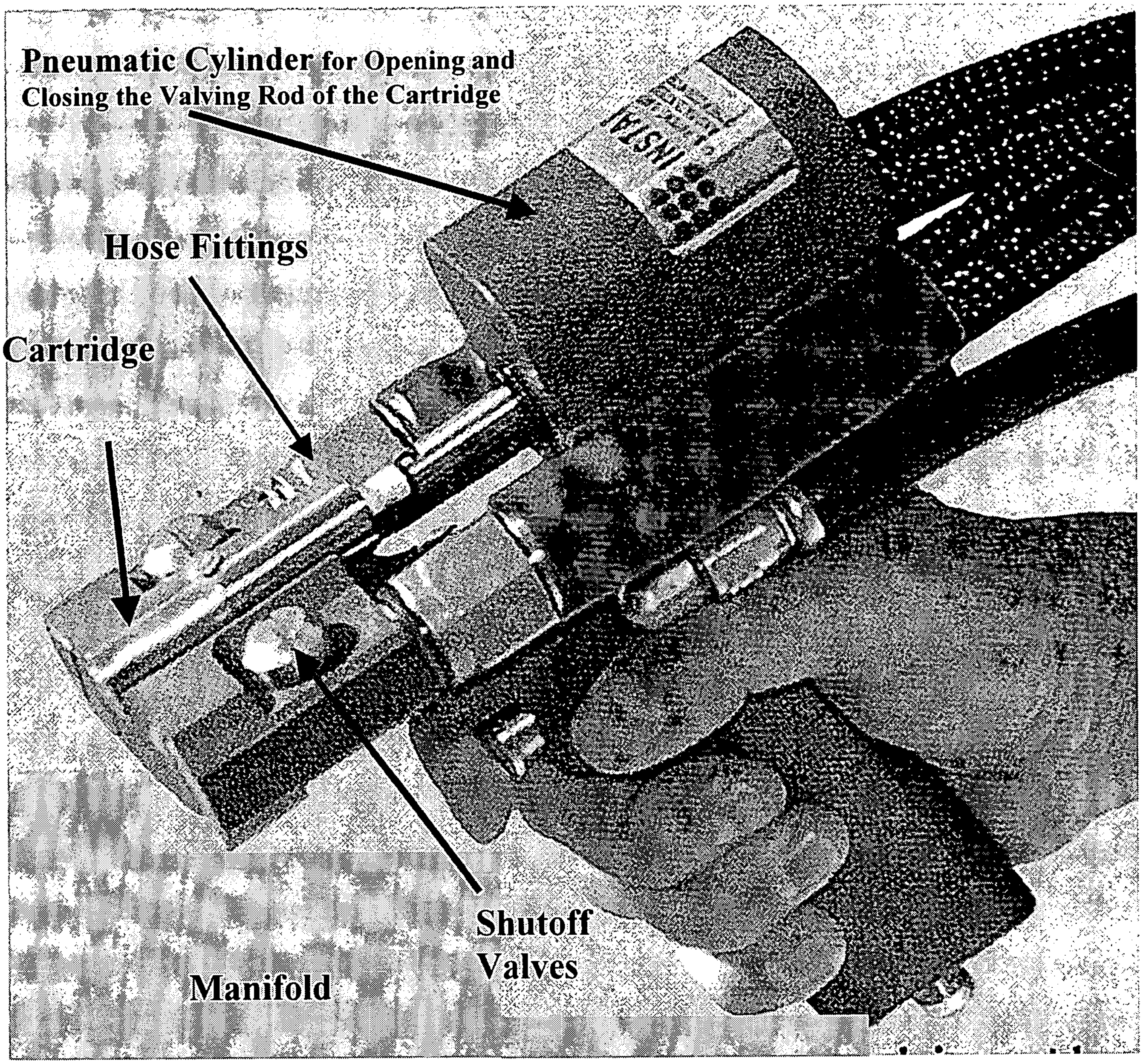
- Since the fitting ID and the Teflon tip OD are about the same, the tip can easily block the flow of chemical to the mixing module, causing a system shutdown.

The problem is addressed under the present invention by designing the input end of the Swivel fitting with castleation or a turret design.

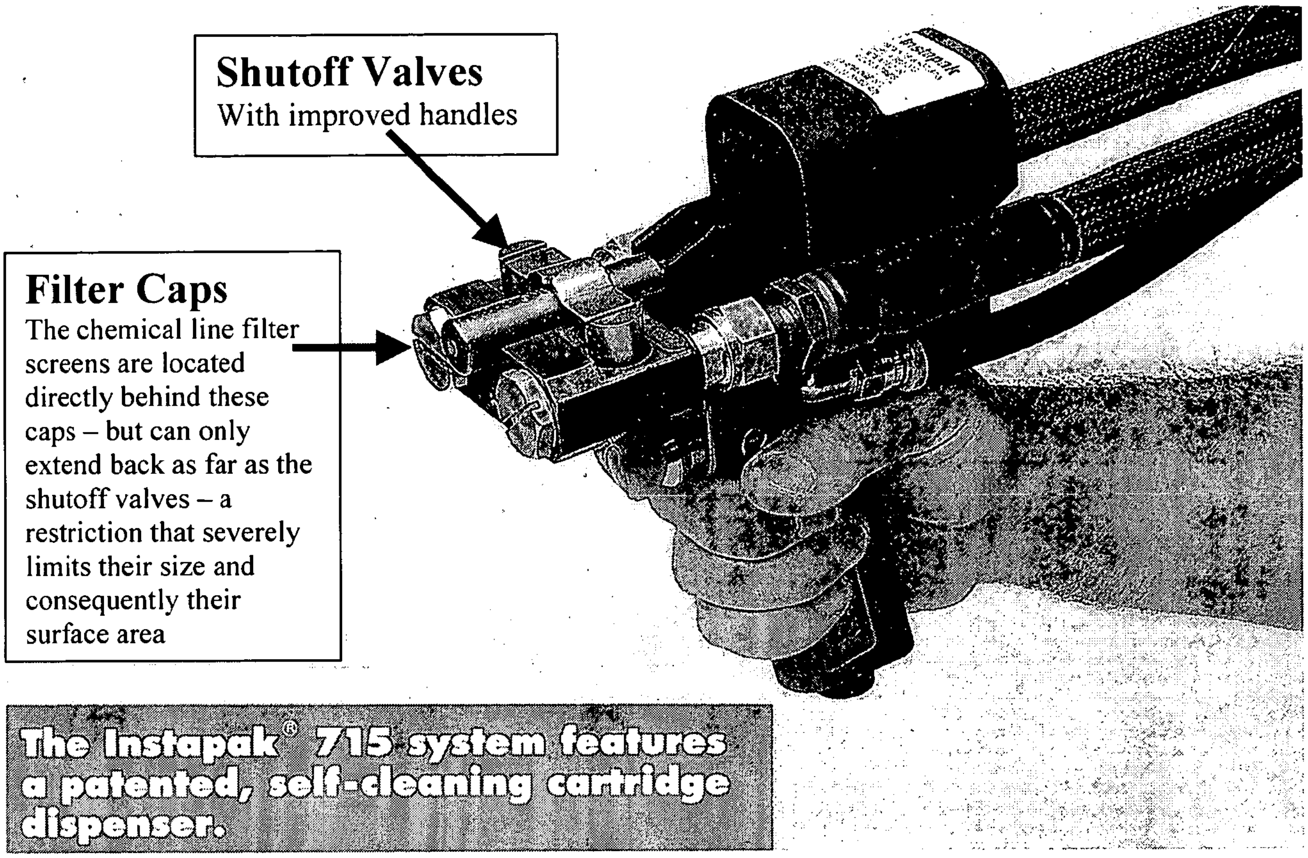
- The Swivel fitting images contained in Figures 30, 37, 38 and 53, which show the tapered, circumferentially spaced projection with adjacent opening which provides for continued flow despite potential abutment of the plug insert at the tip of the heater wire relative to the Swivel fitting.
- This prevents the tip of the heater wire from blocking flow; even if it is pressed in as far as it can go.

---

[7] That is, the heater wire on many hand-held systems extends as closely as possible to the dispenser, in order to minimize the cold shot caused by unheated sections of chemical hose. If the heater wire does not extend to the dispenser, there will be a section of unheated hose – and the chemical in that unheated section will be cooler than the heated section of the hose.



This is a picture of an early version of a Sealed Air pneumatically driven "Cartridge Gun". This type of gun is considered to have been developed in the late 1970's, and put in production until the early 1990's, and is considered to be one of the first dispensers to incorporate the "cartridge" concept. The present invention features a mixing module which is positionable in cartridge like fashion.



This picture shows a later version of a Sealed Air cartridge dispenser, which includes larger valve handles, bigger filter caps, and a protective guard around the rod puller on the cylinder.

A third photo of a Sealed Air cartridge dispenser. As can be seen the manifold has a large width (i.e., the ratio of width W to manifold length L is rather large) and has a front-heavy character. This is in contrast to the aerodynamic aspect of the preferred embodiment of the present invention illustrated later in this document.

For example, by moving components to the rear, dispenser of a preferred embodiment of the present invention gains many advantages over these older designs.

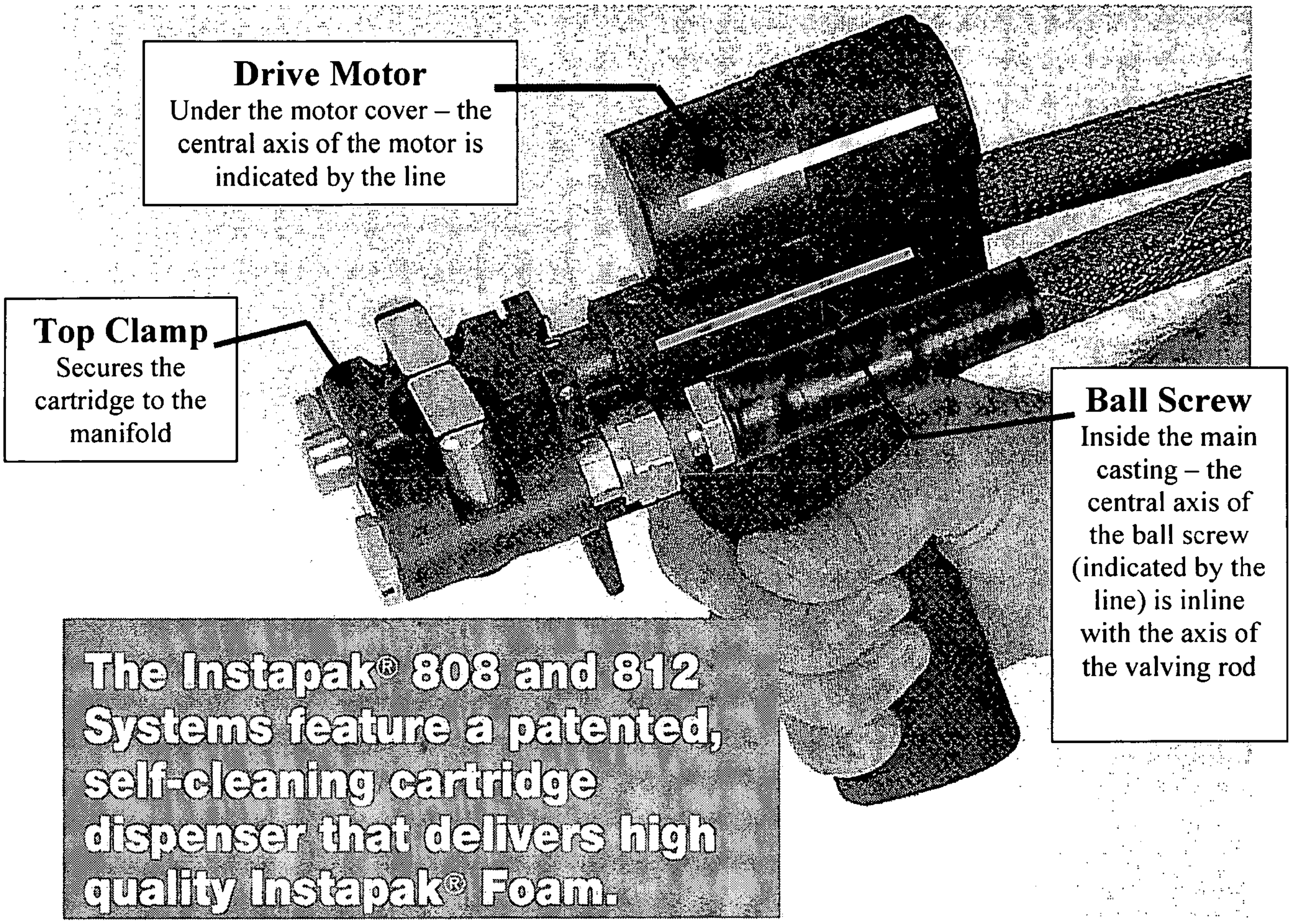


Photo of an All-Electric Dispenser (Sealed Air Series 800)

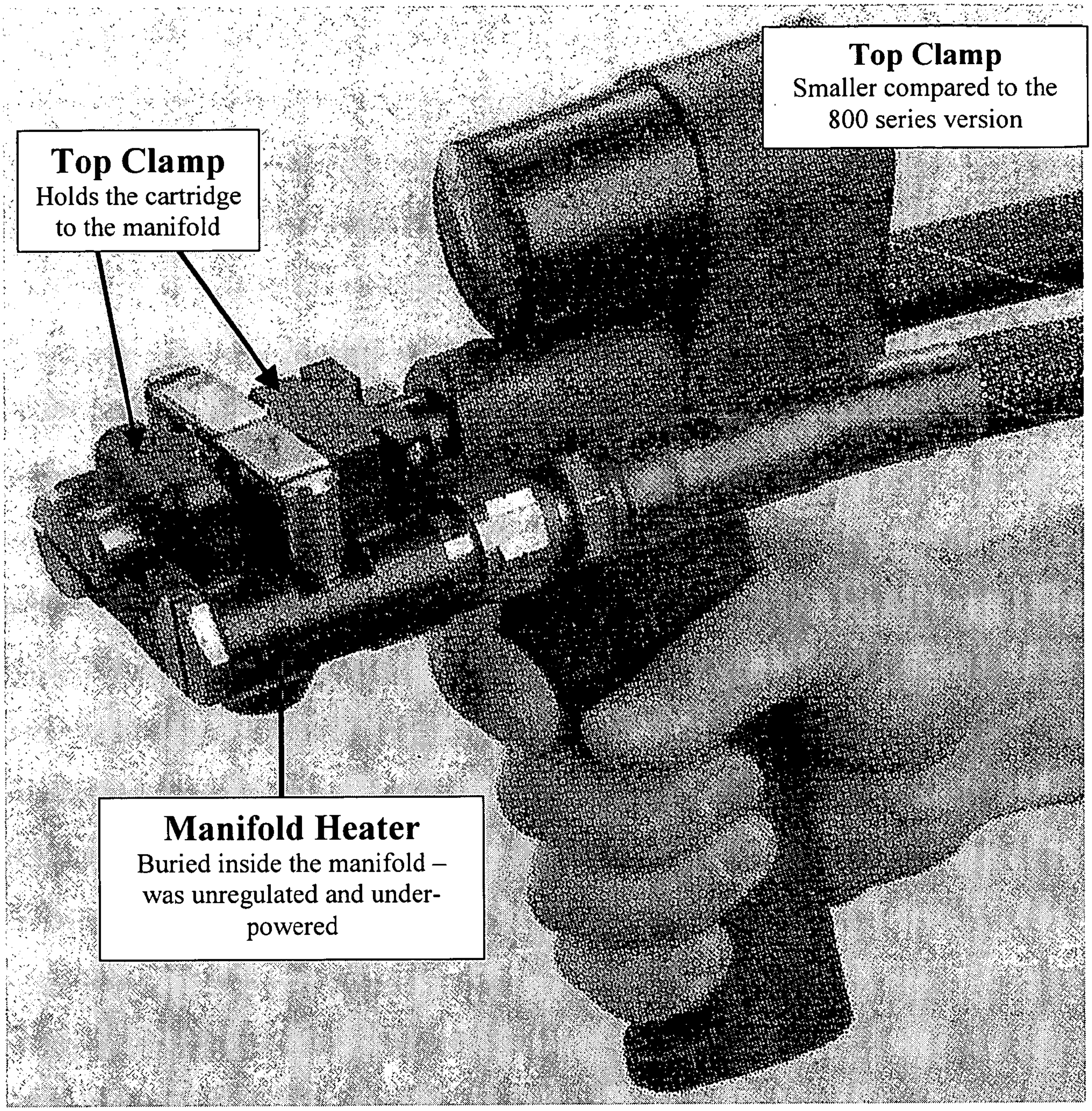
Hand-held dispensers like to 800 series shown above are considered to have been introduced in 1989, and remain in production to this day. The 900-style dispenser, seen below, came out in 1994, but did not entirely displace the 800 series. The design of the manifold, the shutoff valves, the hose connections and the cartridge itself are shown not to have substantially changed in comparison to what was done on the 700 series pneumatic dispensers illustrated earlier.

The top clamp concept shown in the dispenser above was added to the dispenser, together with the addition of a heater element to the manifold in an effort to minimize cold shot.

The top clamp, although effective in doing its job, is a relatively bulky component and added to the manifold yet another component and additional front load weight. The hinge pins for the top clamp are located in the small blocks positioned at the rear end of the clamp.

The manifold heaters used in these models had about 10 to 15 watts of power, and were unregulated, with no positive means of temperature control.

The electric drive motor is mounted directly above the ball screw, as shown in the illustration above.



Another Photo of a Sealed Air 800 series, All-Electric Dispenser

The manifold area of the 800 series is very similar to what is seen on the 700 series, all pneumatic dispensers. Also, as described earlier, the manifold heaters on these units are not very powerful, and are not well suited to raise the temperature of the manifold to more than 115 degrees F under normal circumstances. They also typically require 20 minute or longer warm-up times, which is considered slow in this application.

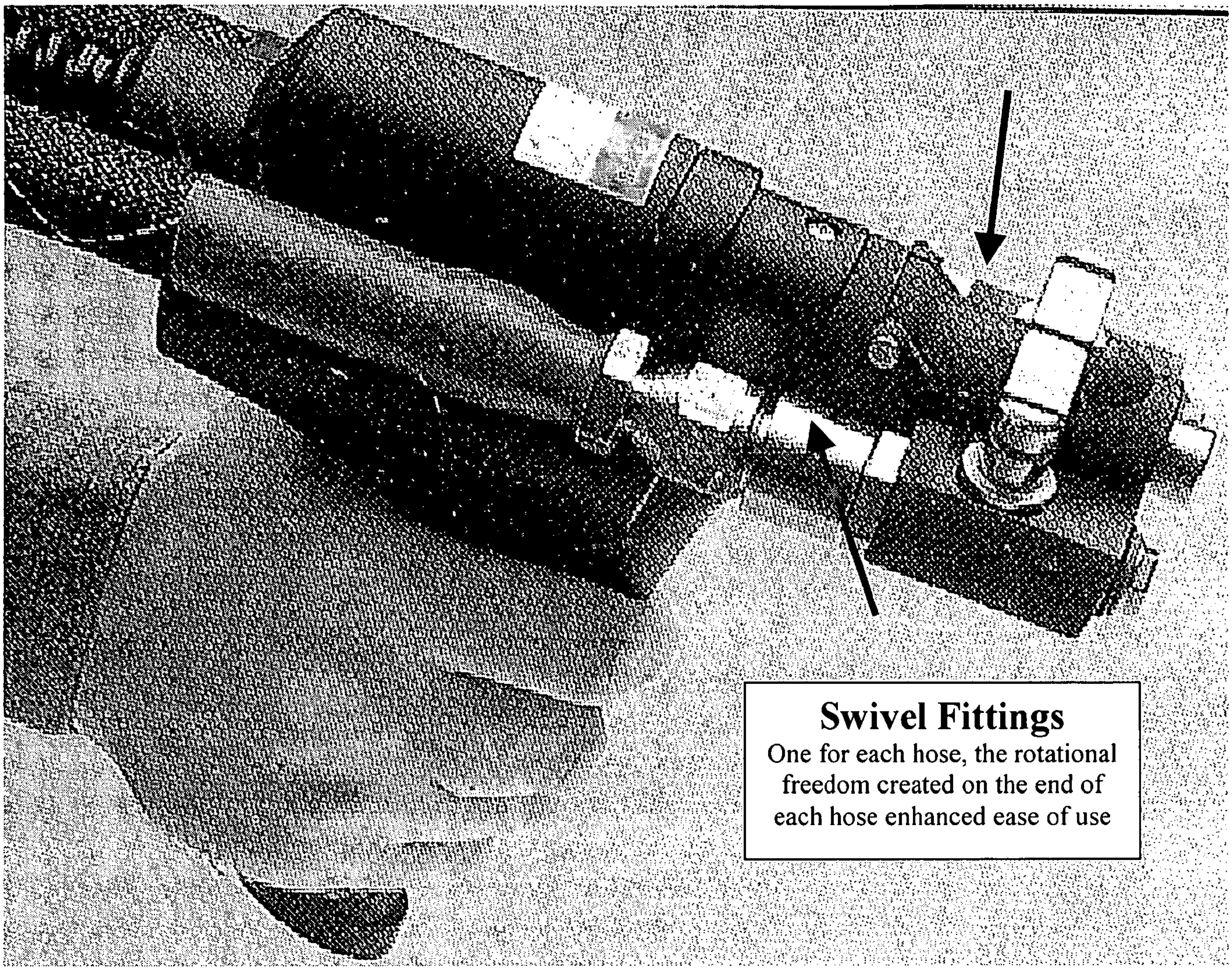


Photo of A Sealed Air 900 Series Dispenser

New features introduced in the 900 series model include:

- Plastic handles and housings – from aluminum on the 800
- Swivel fittings on the end of each hose – enhanced freedom of movement
- Smaller top-clamp – reduced weight - slightly
- Drive Motor moved from above the ball screw – to a position below the ball screw – improved line of sight over the top surface of the dispenser

The general shape and size of the manifold remains about the same as on the 800 series, and the fittings and hose connections remain in about the same position.

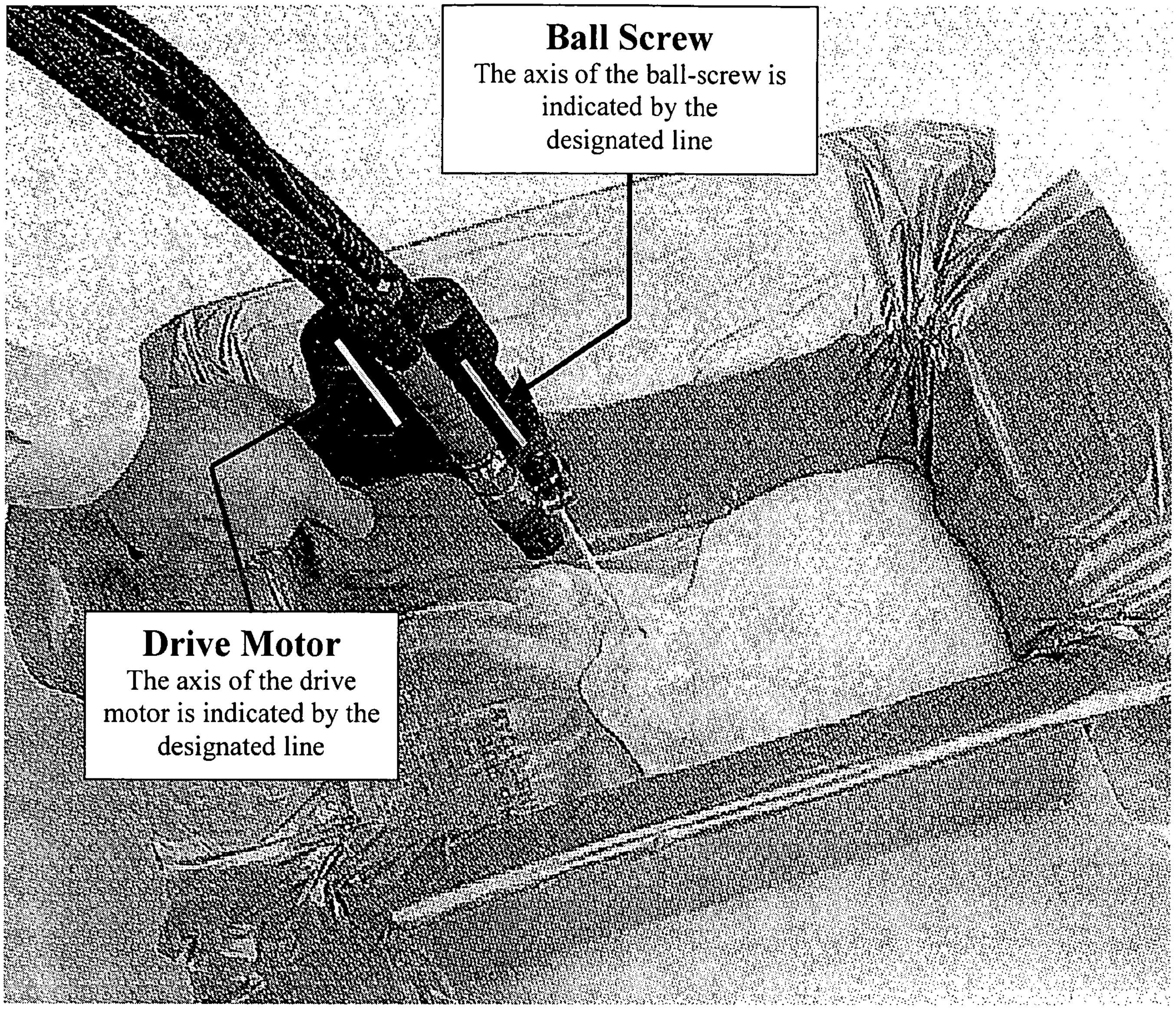
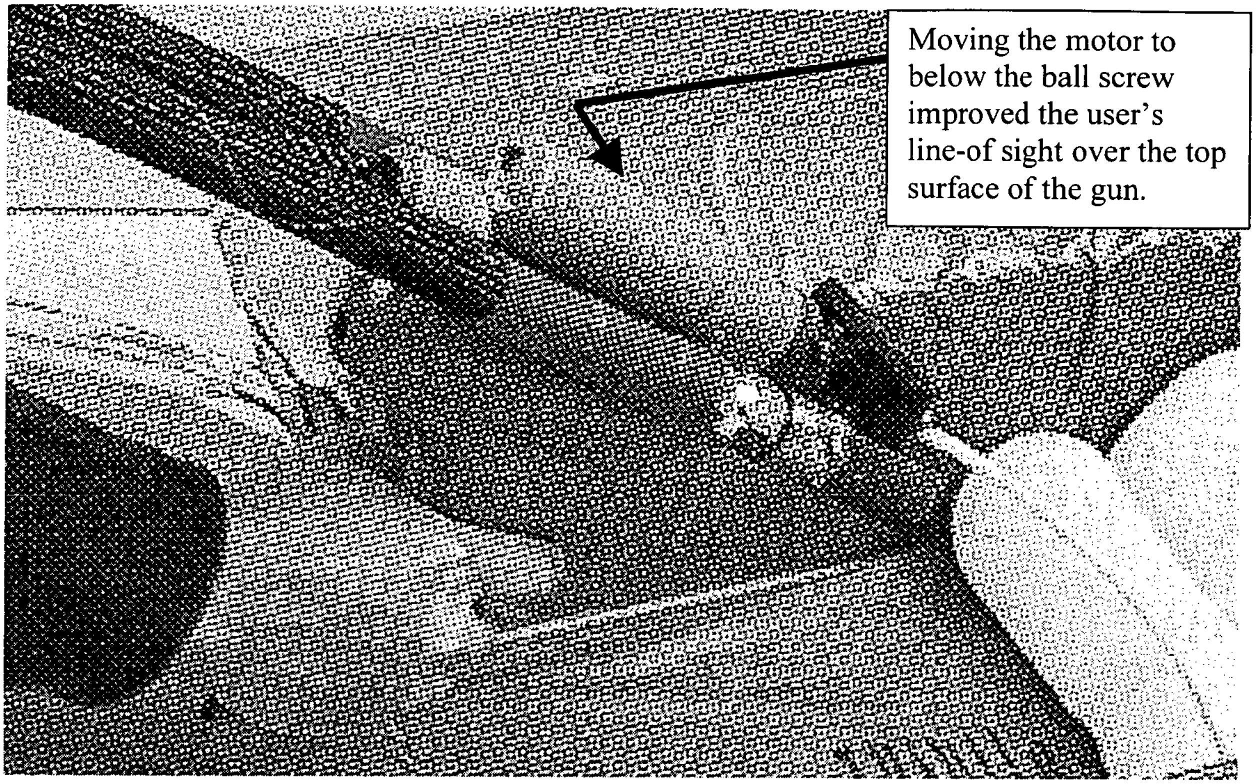


Photo of a 900 Series Dispenser Shooting Foam into a Box

As seen from the above photo, the motor position of the 900 series dispenser changed. In the 800 series design, the motor was positioned above the ball screw, as seen in the photos on the preceding pages. With the 900 series, the motor was now positioned below the ball screw as seen from the two parallel, vertically spaeced apart axes lines in the above illustration.

This change in motor position provided for an improvement in the line-of-sight, over the top of the dispenser, to enhance the users vision as to what was happening on the output side of the operation.



The above photo illustrates a more recent version of the 900 series dispenser, considered to have been introduced in 1994.

BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of preferred embodiments of the present invention can be better appreciated with reference to the following drawings:

Figure 1 shows a dispenser system featuring a hand held dispenser and means for supporting and means for supplying drive force and dispenser material to the hand held dispenser.

Figure 2 shows a closer view of the hand held dispenser with the chemical and electrical supply lines shown in cut-away fashion.

Figure 3 shows a front perspective view of the hand held dispenser of Figure 2.

Figure 4 shows a rear perspective view of the hand held dispenser of Figure 2.

Figure 5 shows a bottom or underside perspective view of the hand held dispenser in Figure 2.

Figure 6 shows an exploded view of the hand held dispenser shown in Figure 2.

Figure 7 shows an exploded (underside) view of the hand held dispenser of Figure 2.

Figure 8 shows the dispenser in Figure 2 with the mixing module component in exploded view relative to the remainder of the dispenser.

Figure 9 shows a view similar to Figure 8, but from a more underside perspective.

Figure 10 shows a view of the means for driving the mixing module rod with the interior transmission shown with the outer housing.

Figure 11 shows a view of the drive train assembly of the present invention with the housing walls shown in solid fashion.

Figure 12 shows an exploded view of the drive train assembly relative to the manifold.

Figure 13 provides an enlarged view of the drive train assembly.

Figure 14 provides an additional view of the drive train assembly of the present invention in a fashion similar to Figure 13 but from a different perspective.

Figure 15 provides an exploded view of the drive train assembly.

Figure 16 shows the main housing assembly comprising the drive transmission received within an encompassing main housing.

Figure 17 shows a bottom view of the main housing assembly, including the manifold mounting screw and position pin apertures.

Figure 18 shows an exploded view of the main housing assembly.

Figure 19 shows in greater detail the ball screw transmission assembly shown in Figure 18.

Figure 20 shows the ball screw assembly in Figure 19 in an exploded view.

Figure 21 shows a rear perspective view of the motor mount assembly.

Figure 22 shows a front perspective view of the motor mount assembly.

Figure 23 shows an exploded view of the motor mount assembly.

Figure 24 shows the motor assembly with motor, drive gear assembly, and associated electrical connections forming part of the motor mount assembly in Figure 23.

Figure 25 provides an exploded view of the motor assembly of Figure 24.

Figure 26 illustrates components of the electrical cable harness assembly with plug receptacle and with associated electrical connectors for electrical connection to the various components downstream from the receptacle receiving exterior electrical umbilical bundle.

Figure 27 shows in an upper perspective view the manifold assembly alone.

Figure 28 shows a lower perspective view of the manifold assembly.

Figure 29 shows a view similar to Figure 28 but from a different perspective.

Figure 30 shows an exploded view of the manifold assembly.

Figure 31 shows an exploded view similar to Figure 30 but from a different perspective.

Figure 32 shows a close up view of one of those plug parts.

Figure 33 shows an assembled elongated filler assembly.

Figure 34 shows an exploded view of the elongated filler assembly.

Figure 37 shows a perspective, see through illustration of the dispenser swivel filler.

Figure 38 shows a view similar to Figure 37 but from a rear to front perspective.

Figure 39 shows an exploded view of the swivel fitting shown in Figures 37 and 38.

Figure 40 shows a perspective view of the handle of the dispenser with a "see through" depiction of the protective trigger covering to illustrate the switch assembly below.

Figure 41 shows an upper perspective view of that which is shown in Figure 40 as well as an associated electrical trigger connector.

Figure 42 shows an exploded view of the handle assembly including the handle and trigger assembly.

Figure 43 shows a trigger assembly of Figure 42 above.

Figure 44 shows a view similar to Figure 43 but from a rear perspective and in an expanded view.

Figure 45 shows an exploded view of the trigger assembly shown in Figure 44.

Figure 46 shows a perspective view of the mixing module with "see through" depiction of internal components.

Figure 47 shows a perspective view similar to Figure 46 but from an underside perspective.

Figure 48 shows an exploded view of the hand held dispenser mixing module shown in Figure 47.

Figure 49 shows a cut away view of the mixing module housing.

Figure 50 shows a perspective view looking into the rear end of the housing.

Figure 51 and 51A provide a technology timeline of sealed air equipment.

Figure 52 shows various views of the hand held dispenser of the present invention.

Figure 53 shows a top plan view of the dispenser with added length illustrations provided for preferred embodiment illustration only (not intended to be limited).

Detailed Description of the Invention

The following illustration show various renderings of preferred embodiment(s) of a dispenser under the present invention and various components and subassemblies.

Figure 1 shows a dispenser system featuring a hand held dispenser and means for supporting and means for supplying drive force and dispenser material to the hand held dispenser.

Figure 2 shows a closer view of the hand held dispenser with the chemical and electrical supply lines shown in cut-away fashion.

Figure 3 shows a perspective view of the hand held dispenser free of chemical and electrical supply line connections. As seen, the tip end of the dispenser is much narrower and more refined than on the previous described hand-held dispensers. This tapering or convergence of the output end region (preferably along the full length of the manifold either with a constant taper in or a stepped tapering in with preferably smooth edging for each segment defining the stepped inside edge manifold). To better realize the slender, tapered nose shape, the larger components like the valve, the swivel fitting, and the hose connections, were moved to the rear of the dispenser. This has the ancillary benefits of protecting these components from the effects of chemical and foam contamination, and shifting the center of gravity rearward, which improves the ergonomics for the user.

Figure 4 shows a rear view of the hand held dispenser of Figure 1

Figure 5 shows an underside, perspective view of the dispenser. As seen in Figure 5 a preferred embodiment of the dispenser features an electric dispenser (e.g., a urethane material dispenser) having an electrical receptacle mounted directly to the handle that provides a readily connectable and releasable insert location for a plug in connection that sufficiently retains connection (e.g., friction through one or more surface wall contacts as in a unitary outer cylindrical (solid or hollowed out) push-pull plug or a multi-prong plug in device or a combination of the same (e.g., a cylindrical outer male sheath with interior multi-prong set). The receptacle shown on the handle can either constitute the female receptacle portion, or the male receptacle portion or both (e.g., a hollow cylindrical with single or multi-prong male connection member). Also, additional securement means can be provided as in the inclusion of mechanical latching (e.g., releasable spring biased clamps or fasten down mechanical connectors which provides extra security against pull apart, but also can increase replacement system down time). The high friction push-pull plug without added mechanical fastening is thus preferred from this standpoint (noting for most typical uses the high friction push-pull plug-in connector provides sufficient protection against inadvertent disconnection during use). A preferred embodiment features a "Lemo" connector which is in reference to plug products produced by Lemo (Switzerland). Previous dispenser designs had a strain relief on the rear of the handle that secured a pigtail wire, and the connection was in line and two to three feet up the hose from the dispenser. This arrangement avoids this while still providing a secure electrical connection.

Figure 6 provides an Exploded View of the hand held dispenser and thus shows how the front cover, motor cover, mixing module, and the handle are configured individually and attached.

Figure 7 shows an Exploded (underside) view of the Dispenser. Figure 7 illustrates how the handle, mixing module, motor cover, and the front cover are individually configured and attached to for the combined dispenser assembly.

Figure 8 shows the dispenser with the mixing module component alone shown in exploded view relative to the remainder of the dispenser. The mixing module provides means for receiving chemical to be dispensed from the outlet. In a preferred embodiment two or more chemicals. For example, in some dispenser uses, synthetic foams such as polyurethane foam are formed from liquid organic resins and polyisocyanates in a mixing chamber provided in the mixing module upon the retraction of a valve rod or other valving means by the motor driven transmission (e.g., the above noted ball screw connection) to a chemical release setting where chemical is free to enter a mixing chamber typically defined by a Teflon cylinder supporting chemical inlet ports. For example, there can be mixed a liquid form of isocyanate, which is often referenced in the industry as chemical "A", and a multi-component liquid blend called polyurethane resin, which is often referenced in the industry as chemical "B"). The mixture can be dispensed into a receptacle, such as a package or a foam-in-place bag (see e.g., U.S. Pat. Nos. 4,674,268, 4,800,708 and 4,854,109), where it reacts to form a polyurethane foam.

A particular problem associated with certain foams is that, once mixed, the organic resin and polyisocyanate generally react relatively rapidly so that their foam product tends to accumulate in all openings which the material contacts for a period of time. Furthermore, some of the more useful polymers that form foamable compositions are adhesive. As a result, the foamable composition, which is often dispensed as a somewhat viscous liquid, tends to adhere to objects that it strikes and then harden in place. Many of these adhesive foamable compositions tenaciously stick to the contact surface making removal particularly difficult. Solvents are often utilized in an effort to remove the hardened foamable composition from surfaces not intended for contact, but even with solvents (particularly when considering the limitations on the type of solvents suited for worker contact or exposure) this can prove to be a difficult task. As seen from the foregoing illustrations, the various components having exterior surfaces of the dispenser of the present invention are interconnected to avoid any gaps between them such as the mixing module and all components associated therewith as in the associated manifold and transmission (e.g., ball screw) casing interface. In addition, providing smooth contour surfaces in the components of the dispenser as in the edging of the manifold both in cross-sectional and along edge length facilitates clean up of adhered foam.

The mixing module is held in place with two socket head cap screws, as shown above. This design provides a very secure mounting for the module, while minimizing the mass of material and hardware required at the front end of the manifold. Creating a dispenser tip that is slender and nearly weightless is also beneficial relative to many intended uses of the present invention.

Figure 9 shows a view similar to Figure 8, but from a more underside perspective. Figure 9 illustrates how the mixing module is simply attached to the manifold with two socket head cap screws. In addition, Figure 9 shows the Trigger Boot providing protection to the aforementioned trigger switch. The trigger boot is preferably made of a flexible, durable material as in a grade of Santoprene plastic material which is a thermoplastic urethane based elastomer (TPU).

Figure 10 provides an illustration of the preferred drive means of the present invention featuring a drive train that includes a motor and transmission. The illustrated transmission is provided for transmitting motor drive to the reciprocating valve or purge rod provided in the mixing module. As seen the motor drive shaft has a gear connected thereto which is in direct driving contact with a gear supported by the drive shaft of the below described ball screw transmission assembly. Figure 10 further illustrates the drive train assembly comprising, in addition to the motor and transmission (e.g., ball screw), the motor mount and main housing which houses the drive transmission.

Figure 11 shows the Drive Train Assembly of a preferred embodiment of the invention mounted to the manifold assembly.

Figure 12 shows an exploded view of the drive train assembly and how it attaches to the manifold assembly (e.g., with four screws). In addition, Figure 12 shows a thermistor and a cartridge heater assembly that provide closed loop temperature control for the manifold assembly, in a fashion directed at removing any cold-shot potential. Figure 12 also shows an anti-rotation (e.g., elastomeric) pad for contact with the transmission housing to help prevent housing rotation counter to transmission rotation.

Figure 13 provides an enlarged view of a preferred drive train assembly with the transmission viewable through the housing.

Figures 14 and 15 show two additional views of the drive train assembly. The lower view is exploded and shows how the motor mount assembly attaches to the main housing with four socket head cap screws.

Figure 16 shows the main housing assembly which comprises the ball screw transmission and the housing that encompasses the transmission and includes mounting means for connection of the main housing assembly to the motor mount as shown in Figure 15.

Figure 17 shows a bottom view of the main housing assembly, including the manifold mounting screw and position pin apertures.

Figure 18 shows an exploded view of the main housing assembly including the ball screw assembly, ball bearing assembly for supporting an inserted end of the shaft of the ball screw assembly, bearing assembly retention clip, hardened steel gear, and threaded, fastened gear, and housing cover for all.

Figure 19 shows the ball screw assembly of Figure 18 in greater detail including the screw with below 9° pitch angle (e.g., 5.5°), cage with ball screw nut driver, o-ring, nut driver and puller which interlocks with the reciprocating end rod. The lower pitch angle feature of the invention, as in the 5.5° pitch shown in Figure 19, avoids slippage by reducing the potential for a "free-wheeling" failure mode.

Figure 20 shows ball screw assembly of Figure 19 in an exploded view. In addition to illustrating individually the aforementioned screw, cage, nut driver, and puller, there is illustrated a grease refill fitting associated with the puller. Thus, service personnel can refill the ball screw with grease by removing the threaded set screw that acts as the refill fitting. Further, Figure 20 shows the ball screw case as having groove reception balls installed.

Figure 21 shows a perspective rear view of the motor mount assembly which includes the motor casing, supported motor, drive shaft gear (Figure 22) and receptacle and receptacle support.

Figure 22 shows a similar view as that of Figure 21 but from a front perspective.

Figure 23 shows an exploded view of the motor mount assembly, which includes an illustration of the motor in association with the motor mount (mounted by securement means as in the three screws illustrated). The plug-in receptacle (e.g., "Lemo" connector) can be fixed in place by providing threads on an exterior surface of the connector and corresponding threads in the motor mount for threaded connection of the connector to the motor mount. Alternate fastening techniques as in mechanical snap fasteners or key/lock attachments are also featured under the present invention.

Figures 24 and 25 provide a perspective and exploded view of the motor assembly of the motor mount assembly shown in Figure 23. As shown, there is attached a gear assembly to the motor shaft with mounting means and there is further provided a grease seal gasket between the front motor facing and the drive shaft gear.

Figure 26 shows components of the downstream cable harness assembly comprising the plug receptacle as in the aforementioned Lemo connector, as well as the connectors for the other dispenser components of the hand held dispenser.

Figure 27 shows an upper perspective view of the manifold housing for feeding chemicals to the chemical outlets to be aligned with the chemical inlet ports of the mixing module (one of two shown on the sloped walls at the front of the manifold), the chemical on/off line valves as well as the bearing supported chemical line swivel connectors.

Figure 28 shows a larger perspective view of the manifold assembly including the capped filter access ports at the very forward far end of the manifold wings and the castellated heated chemical line swivel fitting connectors at the far opposite end.

Figure 29 shows the manifold assembly shown in Figure 28, but from a different perspective. Figure 29 also shows a suitable manifold cartridge heater cavity opening out at the base of the u-shaped portion of the manifold (having legs defined by the two independent chemical line extension with on/off valving).

Figure 30 shows an exploded view of the manifold assembly including the tubular filter assemblies that slide within the elongated cavities provided in the manifold wings that extend downstream from the manifold casings which receive in transverse fashion the rotatably on/off line valves and axially the swivel fittings for connection to heated chemical hoses.

As seen, the enlarged tubular filters extend for a significant portion of the elongated length of the manifold. For example, Figure 53 illustrates some illustrative (not intended to be limiting) size dimensions for the gun dispenser and particularly the streamlined manifold. As seen from Figure 53, the streamlined lift and right wings of the manifold represent the exterior sides of the solid portion of the manifold or the portion having widthwise completion by either a solid body or interconnecting (e.g., a truss arrangement) which also provides for mixing module mounting. This length is also generally equal to the chemical passage length extending to the two outlets on the tapered walls of the manifold. A preferred usable filter length is preferably 20 % or more of that

wing portions extending from the length valve casing to the free end tip of the dispenser (or chemical line extension in the manifold), more preferably 30 % or more, with about 45 % $\pm$ 5 % being illustrative. The tubular filters are preferably a "304" stainless steel standard grade woven wire cloth with a 2.41 inch usable filter length. Tubular filters with, for example, .174OD x 0.156ID with a 100 x 100 mesh, 30.3 % open area and a .0055 opening width.

Figure 31 shows a second exploded view of the manifold assembly, including two port plugs provided at the front end of the manifold sections supporting the on/off valving. As shown, the plug ports have a central axis arranged perpendicular to the chemical flow line. Also, with reference to Figure 53, the above noted "solid" or mixing module support portion with wing extensions, has an axial length which is greater than its width as in L/W of 1.5/1 to 3/1 ratio with about 2/1 preferred.

Figure 32 shows a close up of one of the port plugs shown in Figure 31 that provide means for sealing the side port of the manifold.

Figures 33 and 34 shows a perspective view of the filter assembly associated with the manifold assembly described above which includes an elongated filter with tapered closed off upstream end and on open engagement end (e.g., a male fitting attachment component having spaced apart enlarged surface areas separated by grooves. The male fittings are provided at the rear end of an insert member that is preferably threadably received by threaded apertures provided at the forward most end of the manifold housing and has a tool engagement head as in an allan wrench socket. This insert member further includes outlet ports designated to feed the chemical outlet ports positioned for feeding the mixing module and an annular seal thereabout. The filter (screen) material used is designed to be sufficiently porous to avoid undesirable levels of pressure back up, but one having small enough porosity to avoid particle contamination downstream as in chemical port blockage at the mixing module chemical ports. The filters are preferably designed to provide a filtering surface area of more than five times greater than that of the illustrative prior art herein with even greater potential for expansion as in are ten times either with single wall tubular filters or ones having labyrinth interiors.

Figures 35 and 36 show a cartridge heater (e.g., 150 watts at 24 volts) that is supported by the manifold (e.g., a central rear end position to provide symmetric dual chemical line heating). This heater is operated by a suitable control unit which receives sensed temperature information from a closely associated sensor (e.g., thermistor). The thermistor has its resistance changing as a function of time, and the sensing element for the thermistor is potted into a stainless steel tube with a closed end.

Figures 37 and 38 show a perspective, "see through" view of the "A" chemical line swivel fitting, which includes internal axially spaced apart roller bearing sets with an intermediate axially spaced apart pair of o-ring seals. At the rear end is provided means for connection to the feed end of a chemical A or B conduit (e.g., castellation or pointed, sloped turret configuration). The opposite end is designed for manifold insertion and also features a base seal and chemical outlet for feeding into the manifold chemical passageway extending along the manifold wings and subject to temperature control by the aforementioned heater cartridge.

Figure 39 shows an exploded view of the dispenser swivel fitting including the aforementioned double seal and double bearing arrangement.

Figure 40 shows a perspective view of the handle assembly of the dispenser with a "see though" depiction of the protective trigger covering and the underlying spring biased trigger assembly. The handle is preferably machined from a solid block of plastic (e.g., DELRIN plastic).

Figure 41 shows an upper perspective view of the upper reception portion to which the aforementioned dispenser components are attached as well as a trigger reception cavity.

Figure 42 shows an exploded view of the handle assembly including the handle and trigger assembly.

Figure 43 shows the trigger assembly (trigger boot, two robust trigger switch module sections and electrical connector) shown in Figure 42 with the associated electrical connector, spring biased switch and protective support covering shown in exploded fashion.

Figure 44 shows a view similar to Figure 43 but in an enlarged, rear perspective. Figure 44 further illustrates the integrated electrical plug connection means also supported by the protective casing designed in cartridge or module fashion for insertion into the reception cavity in the handle and which completely encompasses the spring biased contact switch assembly but for a small exposed switch projection that is locked in a cavity region between the cartridge and the above described plastic protective finger contact covering. As trigger switches are one of the most unreliable components on all previous hand-held dispenser designs, the trigger module shown in the figure is designed to survive all foreseeable impact loads, and for trouble free operation for the life of the system. By isolating the relatively fragile microswitch inside of the module, there is created a design that can survive reasonably harsh impact loads from any direction. The microswitch is isolated from impact and protected by the two switch housings (e.g., aluminum casings) and the plunger design. The illustrated (brass) plunger has an annular shoulder that limits the travel of the plunger to protect the switch from impact. There is also illustrated a return spring for the plunger.

Figure 45 shows an exploded view of the trigger assembly shown in Figure 44 which includes the protective, rigid casing formed by two half sections fastened together with fasteners, the trigger mechanism with contact trigger portion, biasing spring and electrical contact sensor with electrical plug connectors. The latter three components being protectively covered by the half sections which include reception cavities for receiving the components and providing for the trigger and contact mechanism movements.

Figure 46 shows a perspective view of the mixing module designed for releasable connection both to the chemical feeding manifold (one of two angled, module chemical inlet ports with associated o-ring seal is shown in Figure. 46 at the lower front end) as well as the drive train for reciprocating the valve rod having its forward most end just protruding out from the hardened dispenser tip cap. Reference is made to US Pat. Appln. No. 10/623,716 filed July 22, 2003 directed at a mixing module design sharing some similarities with the mixing module shown above, and which application is incorporated by reference. Figure 46 further shows the mixing module having a lower projection

block for secure fastening with the manifold and/or handle housing (manifold in the illustrated preferred embodiment). Figure 46 additionally illustrates a releasing solvent access cap at the module housings top intermediate region.

Figure 47 shows an underside perspective view of the mixing module showing the opposite in feed chemical port and also the open bottom housing flange or cowling surrounding the enlarged capture end of the valve rod which extends through the threaded back cap in sliding fashion relative to the smaller diameter portion of the valve rod.

Figure 48 shows an exploded view of the mixing module shown in Figure 47 including in front to rear axial order, the hardened tip cap, the Teflon mixing chamber, the spacer sleeve with solvent access openings, the compression means (e.g., the stack of Bellville washers shown) the mixing module housing, seal ring, the threaded back cap, rod engager, and reciprocator rod with enlarged capture end.

Figure 49 shows in cut away fashion the mixing module housing including its lower mounting block for reception of fasteners (e.g., two preferably extending through or from the manifold and preferably an added position pin recess (or vice versa)).

Figure 50 shows the interior of the mixing module housing from a rear to front end perspective. By way of the axial semi-grooves or serrations (cavities) found in the side wall of the mixing housing, the housing for the mixing module is extensively modified (machined) to increase its internal volume, to increase its solvent capacity by about five times compared to previous designs. In addition, the U-shaped, rear cover or hood feature has been added to the rear section of the housing, for added protection against chemical contamination. In addition, this semi-circular hood at the back end of the housing is designed to protect the area around the puller that mates with the end of the valving rod, from foam, solvent, and chemical.

Figures 51 and 51A show a sales brochure with description of a time-line of development.

Figures 52 illustrates an assembled embodiment of the hand held dispenser from a perspective view.

Figure 53 shows a top plan view of the dispenser with added length illustrations provided for preferred embodiment illustration only (not intended to be limiting).

What is claimed is:

1. The inventive subject matter set forth in the above description and drawings.

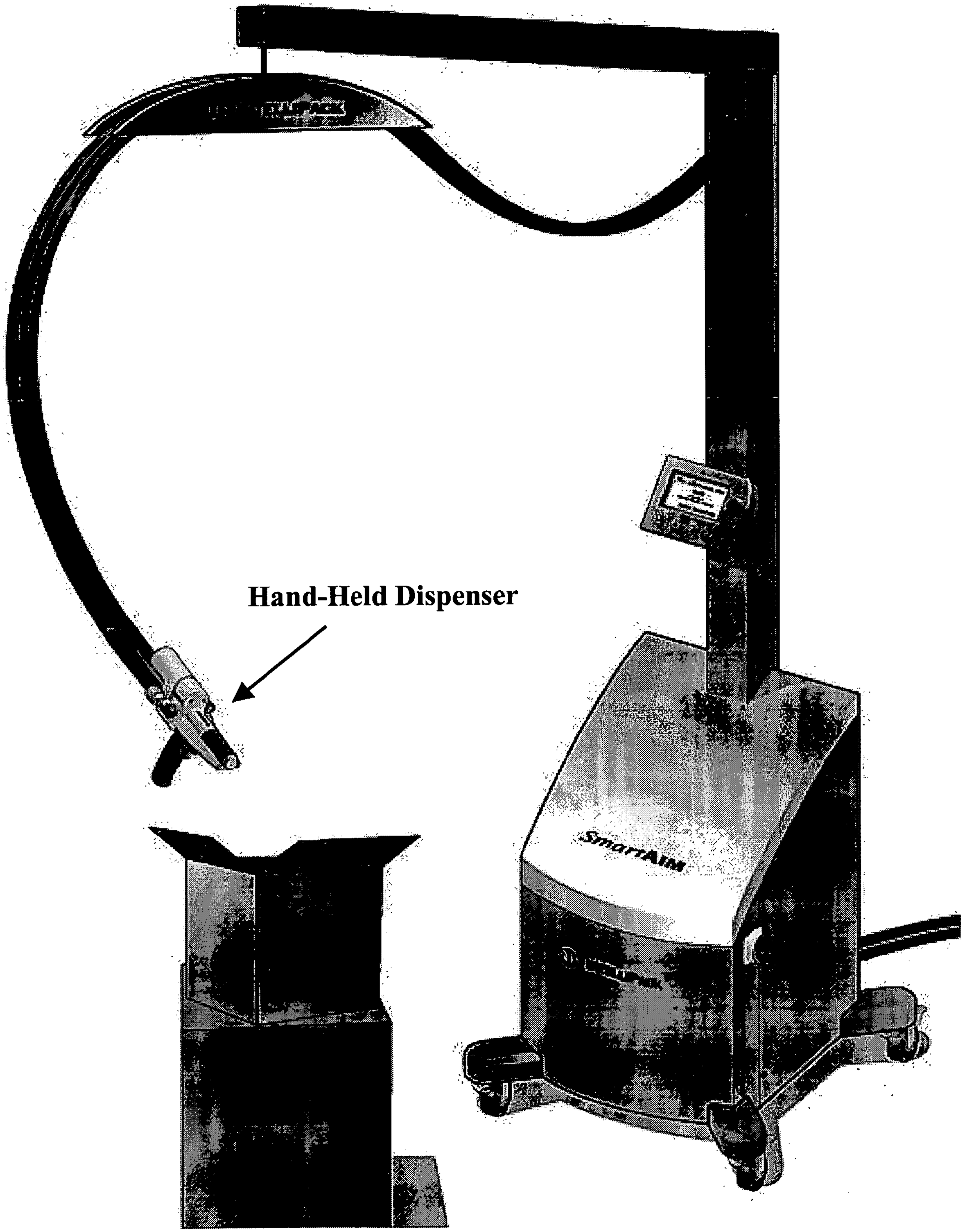


FIG. 1

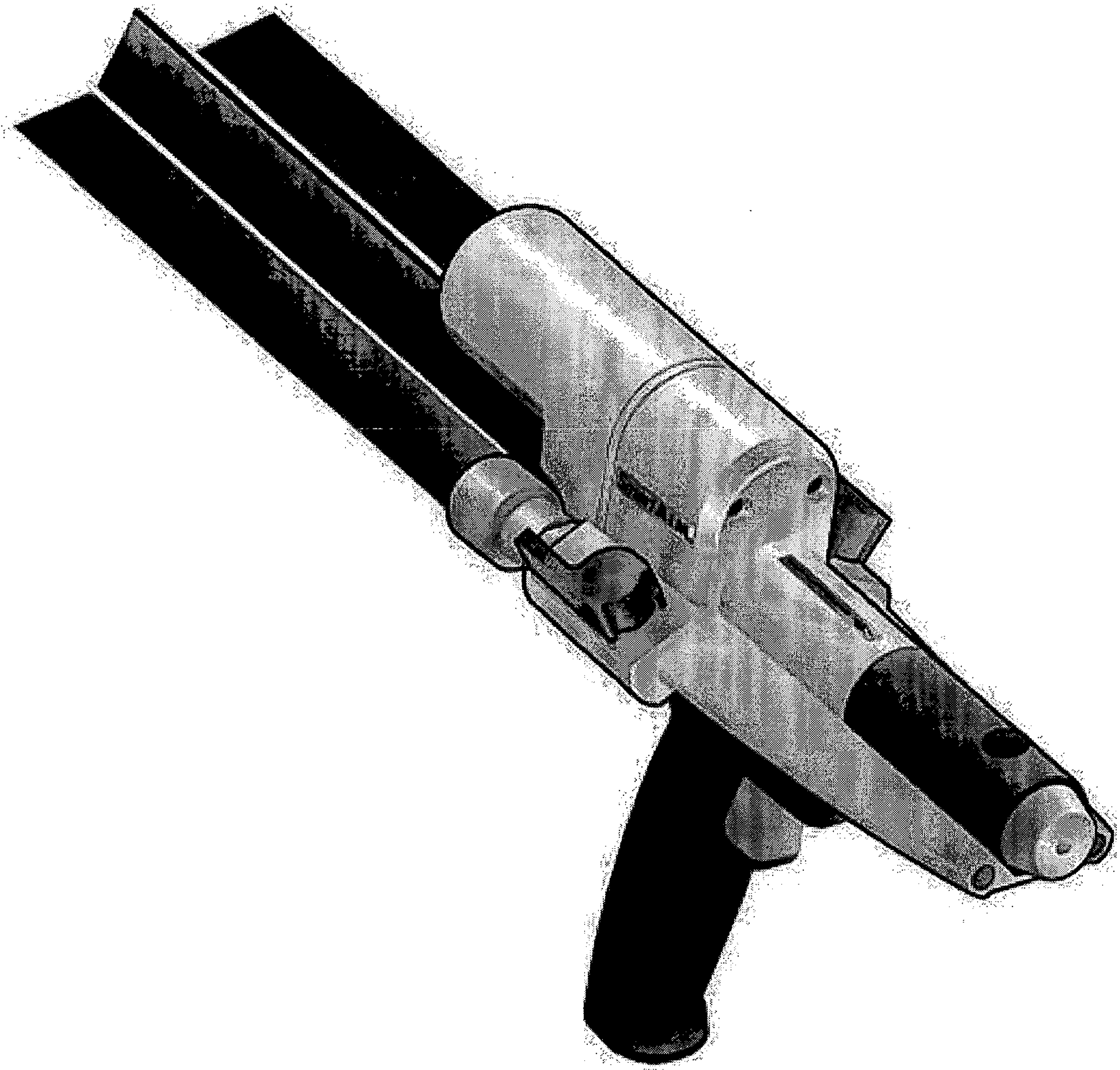


FIG. 2

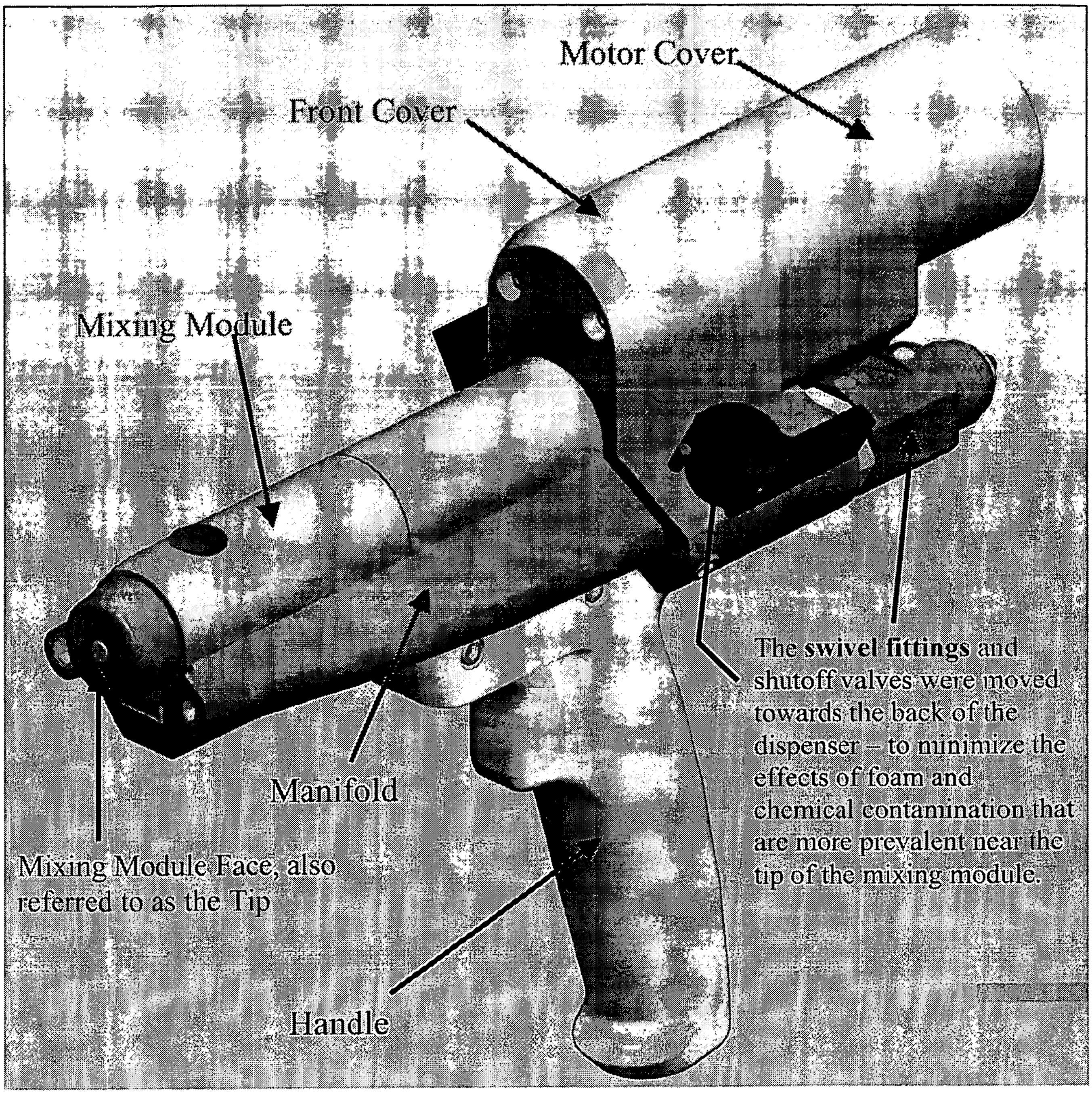

Motor Cover
Front Cover
Mixing Module
Manifold
Mixing Module Face, also referred to as the Tip
Handle
The **swivel fittings** and shutoff valves were moved towards the back of the dispenser – to minimize the effects of foam and chemical contamination that are more prevalent near the tip of the mixing module.

FIG. 3

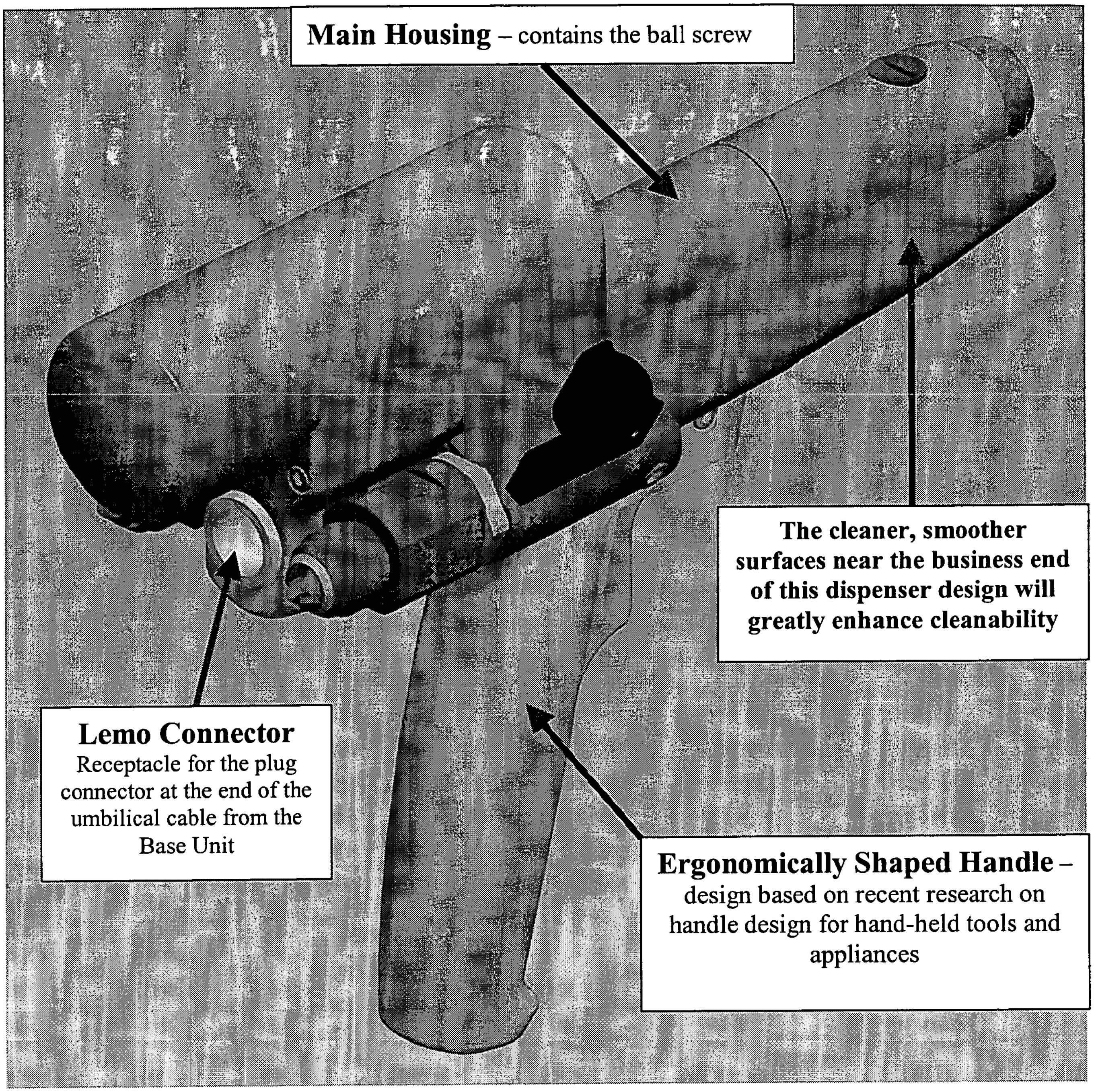

Main Housing – contains the ball screw
The cleaner, smoother surfaces near the business end of this dispenser design will greatly enhance cleanability
Lemo Connector
Receptacle for the plug connector at the end of the umbilical cable from the Base Unit
Ergonomically Shaped Handle – design based on recent research on handle design for hand-held tools and appliances

FIG. 4

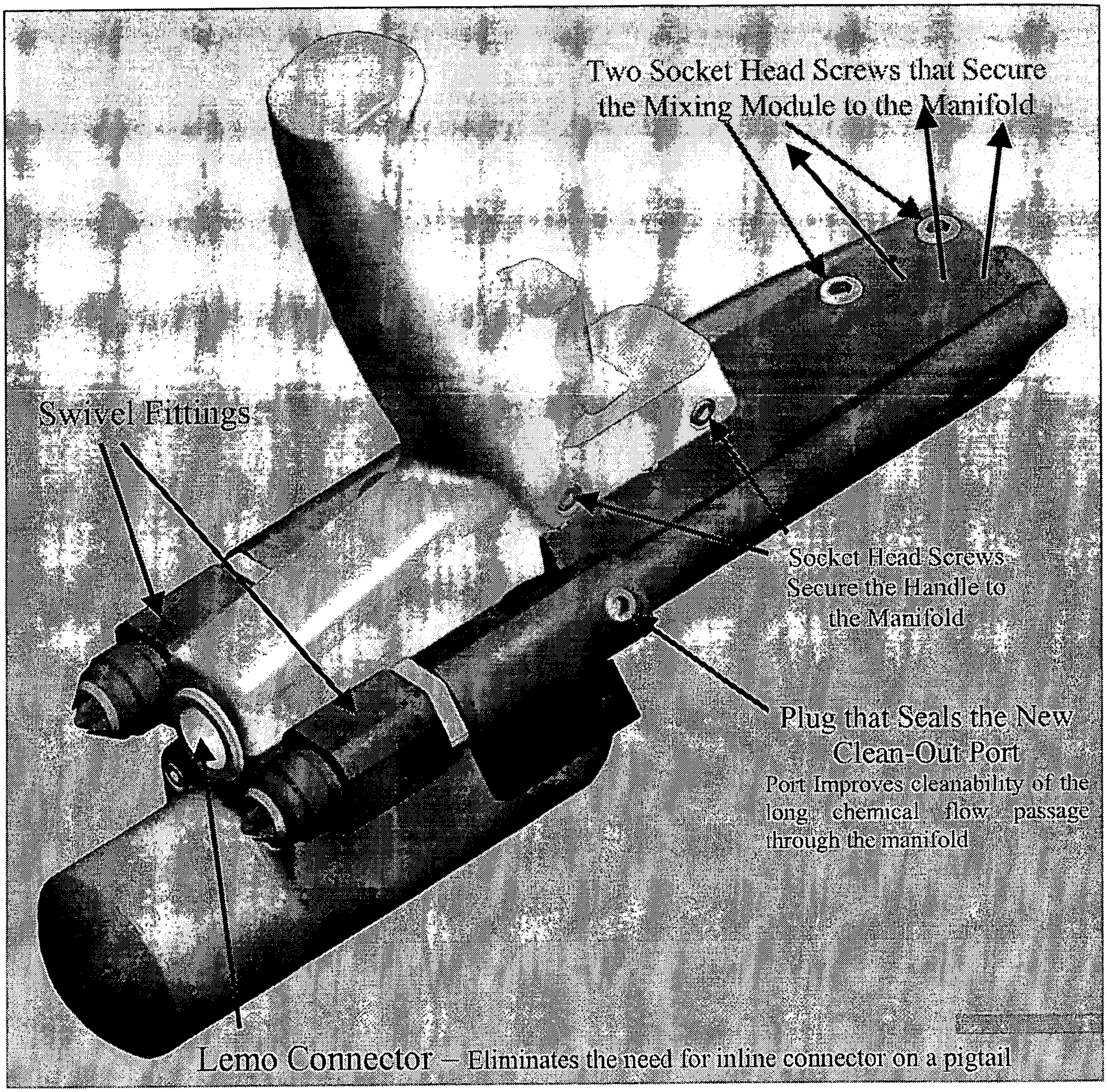

Two Socket Head Screws that Secure the Mixing Module to the Manifold
Swivel Fittings
Socket Head Screws Secure the Handle to the Manifold
Plug that Seals the New Clean-Out Port
Port Improves cleanability of the long chemical flow passage through the manifold
Lemo Connector – Eliminates the need for inline connector on a pigtail

FIG. 5

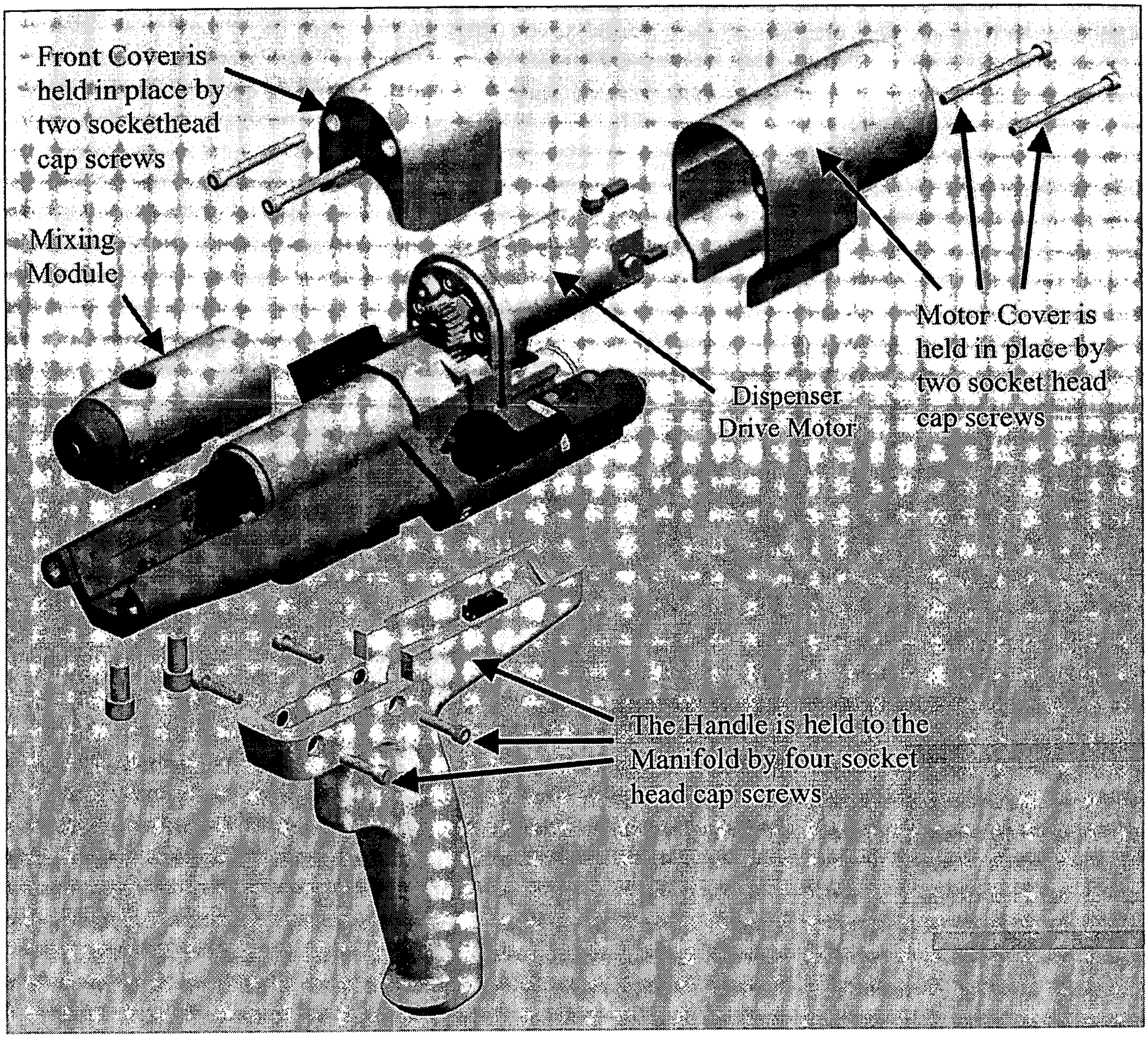

Front Cover is held in place by two sockethead cap screws
Mixing Module
Dispenser Drive Motor
Motor Cover is held in place by two socket head cap screws
The Handle is held to the Manifold by four socket head cap screws

FIG. 6

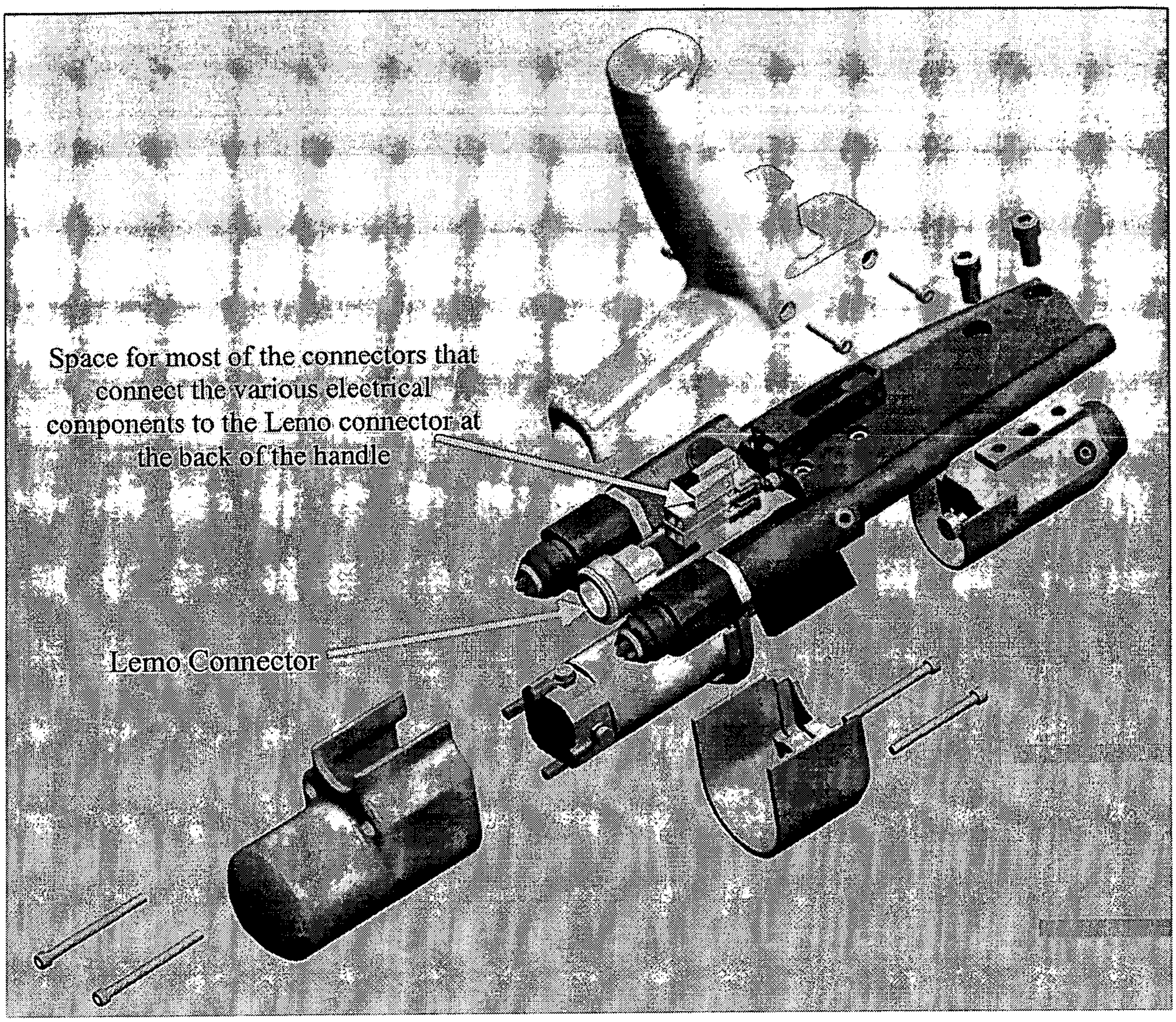

Space for most of the connectors that connect the various electrical components to the Lemo connector at the back of the handle
Lemo Connector

FIG. 7

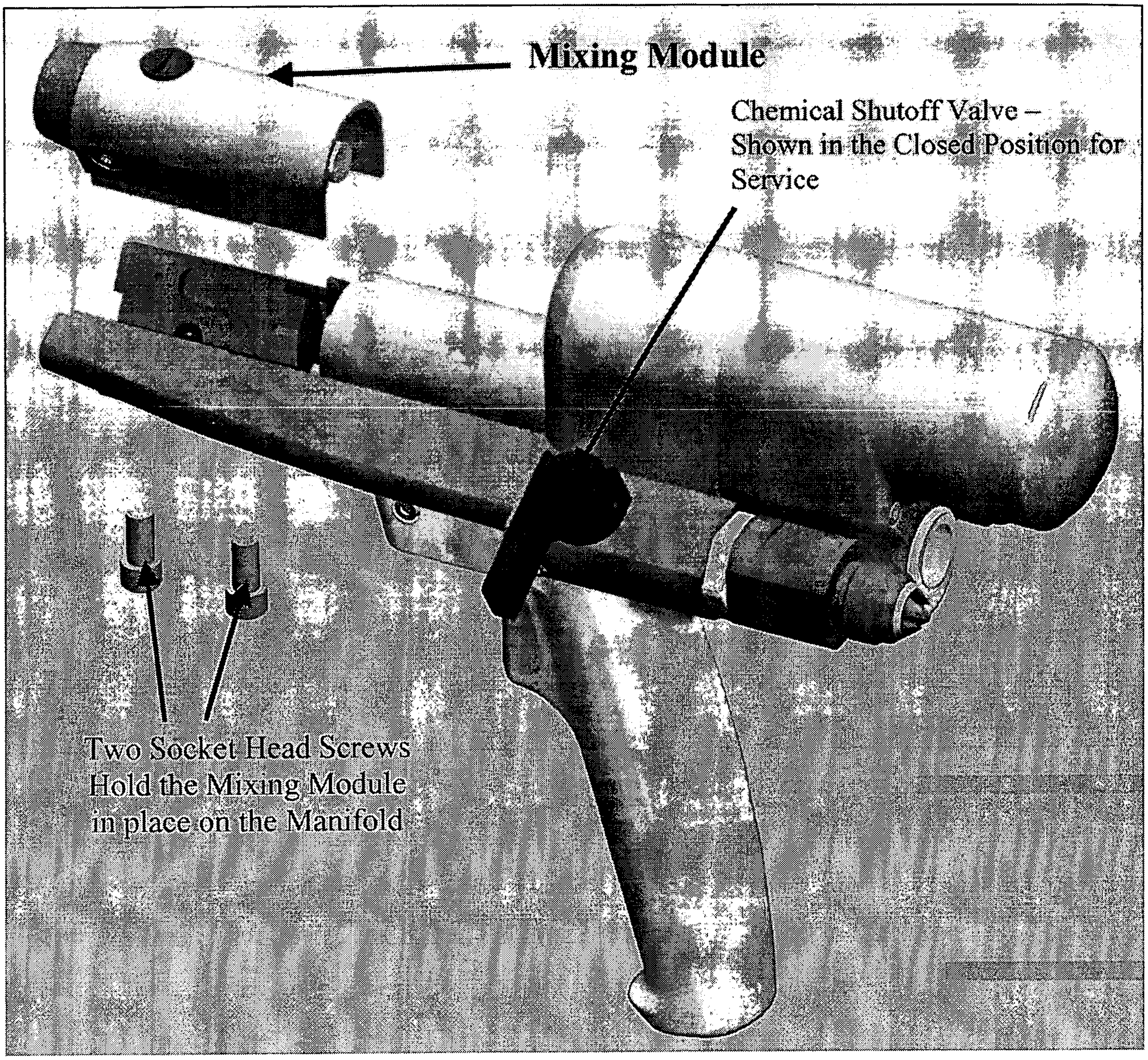

Mixing Module
Chemical Shutoff Valve –
Shown in the Closed Position for
Service
Two Socket Head Screws
Hold the Mixing Module
in place on the Manifold

FIG. 8

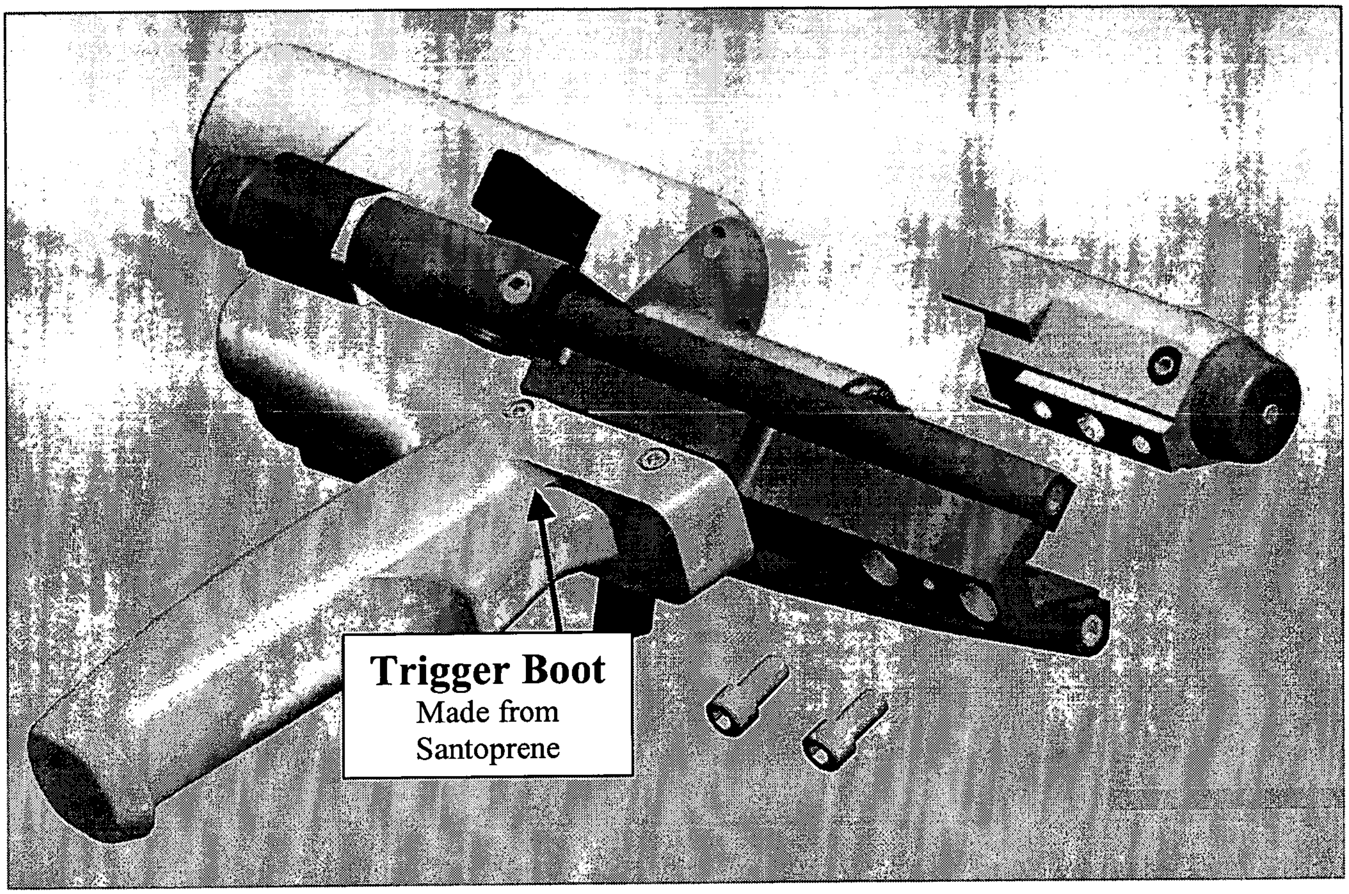


FIG. 9

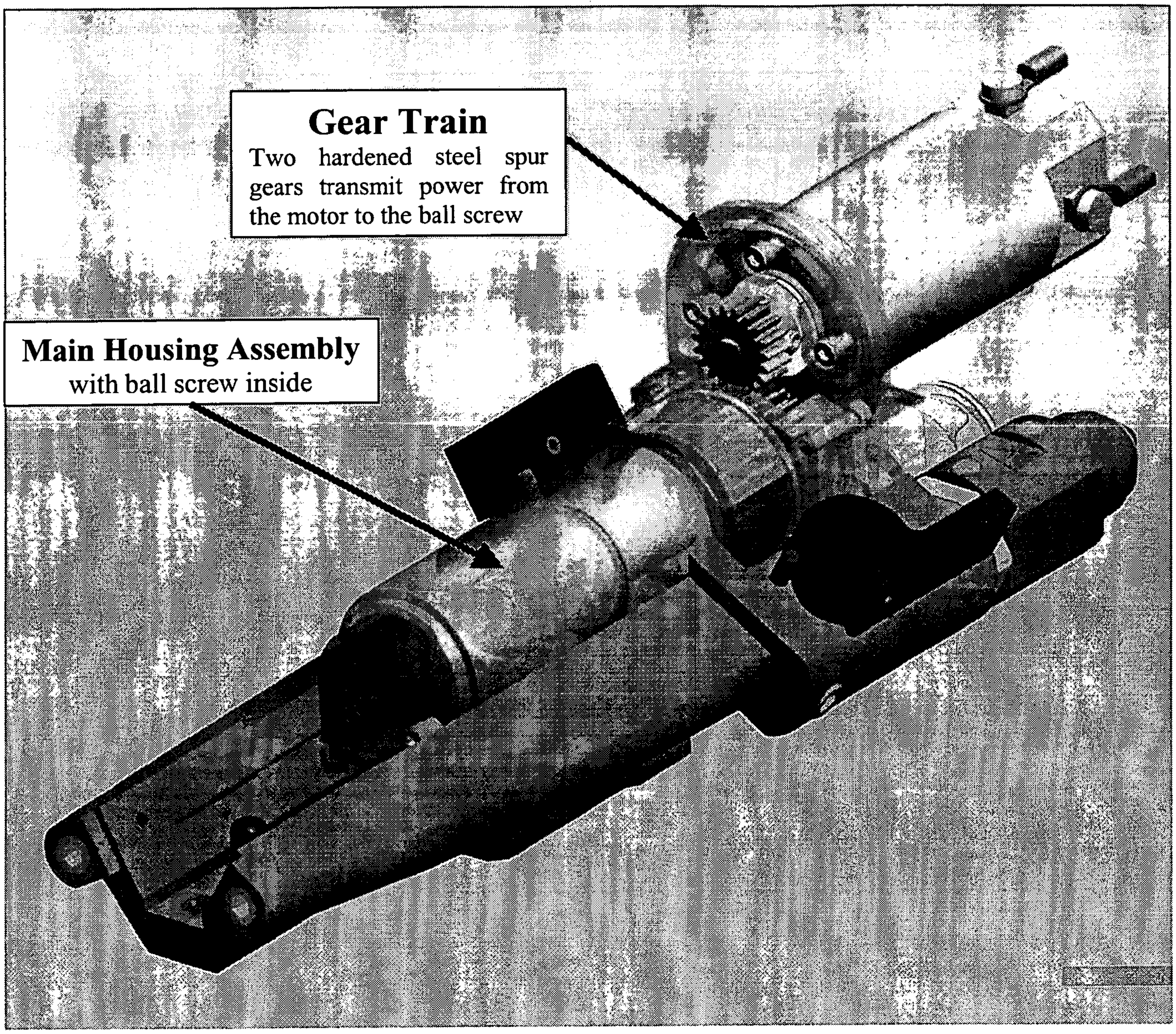

Gear Train
Two hardened steel spur gears transmit power from the motor to the ball screw
Main Housing Assembly
with ball screw inside

FIG. 10

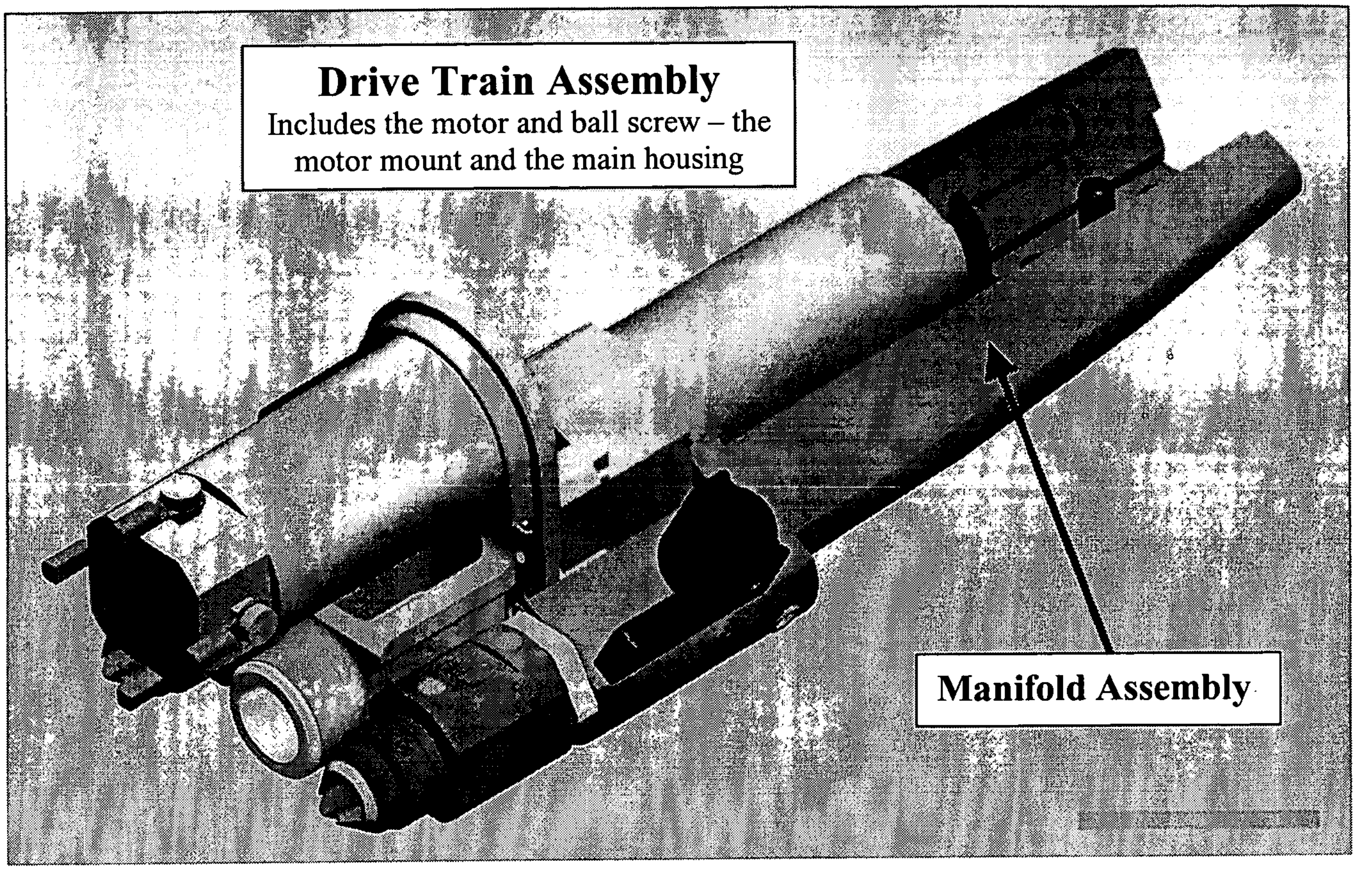

Drive Train Assembly
Includes the motor and ball screw – the motor mount and the main housing
Manifold Assembly

FIG. 11

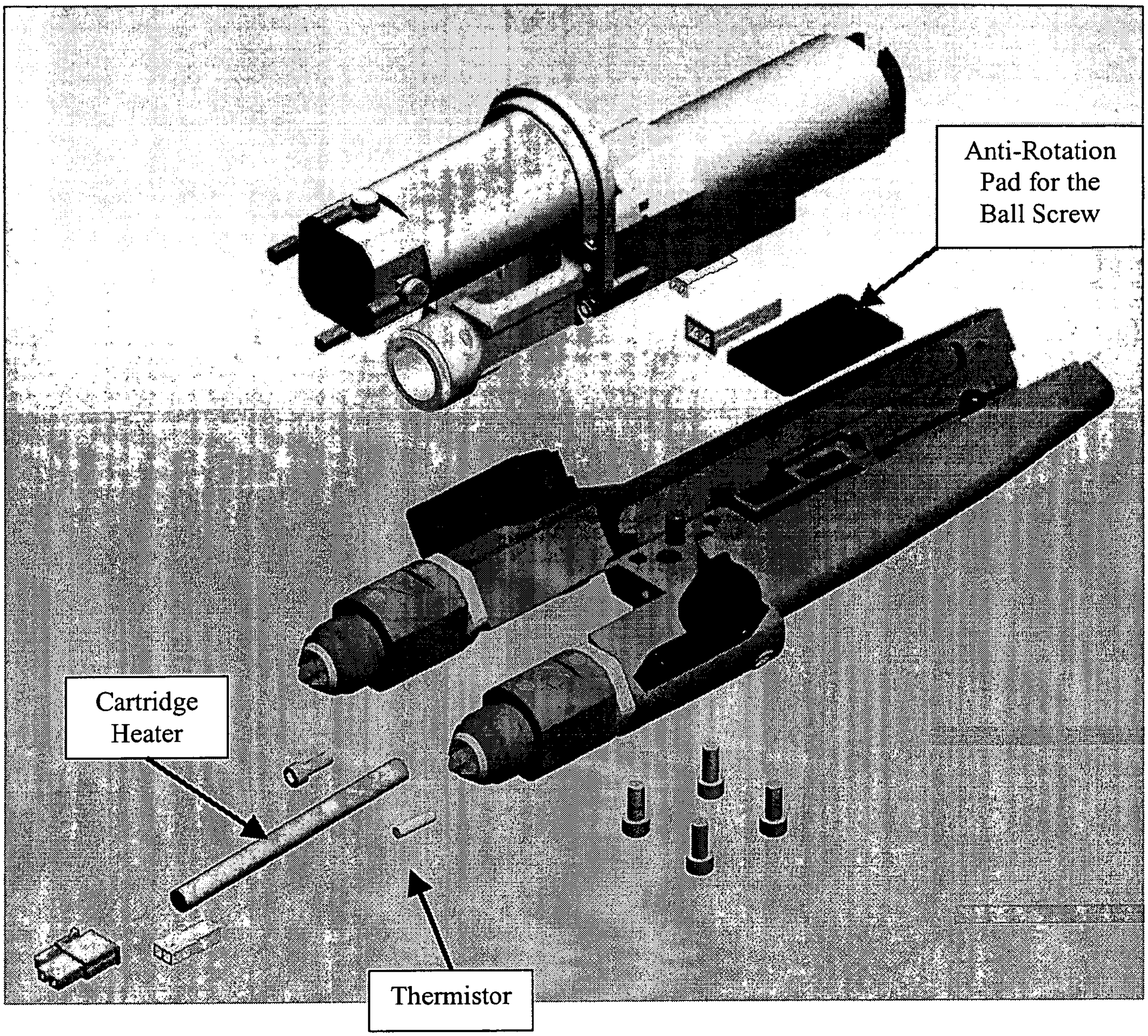

Anti-Rotation
Pad for the
Ball Screw
Cartridge
Heater
Thermistor

FIG. 12

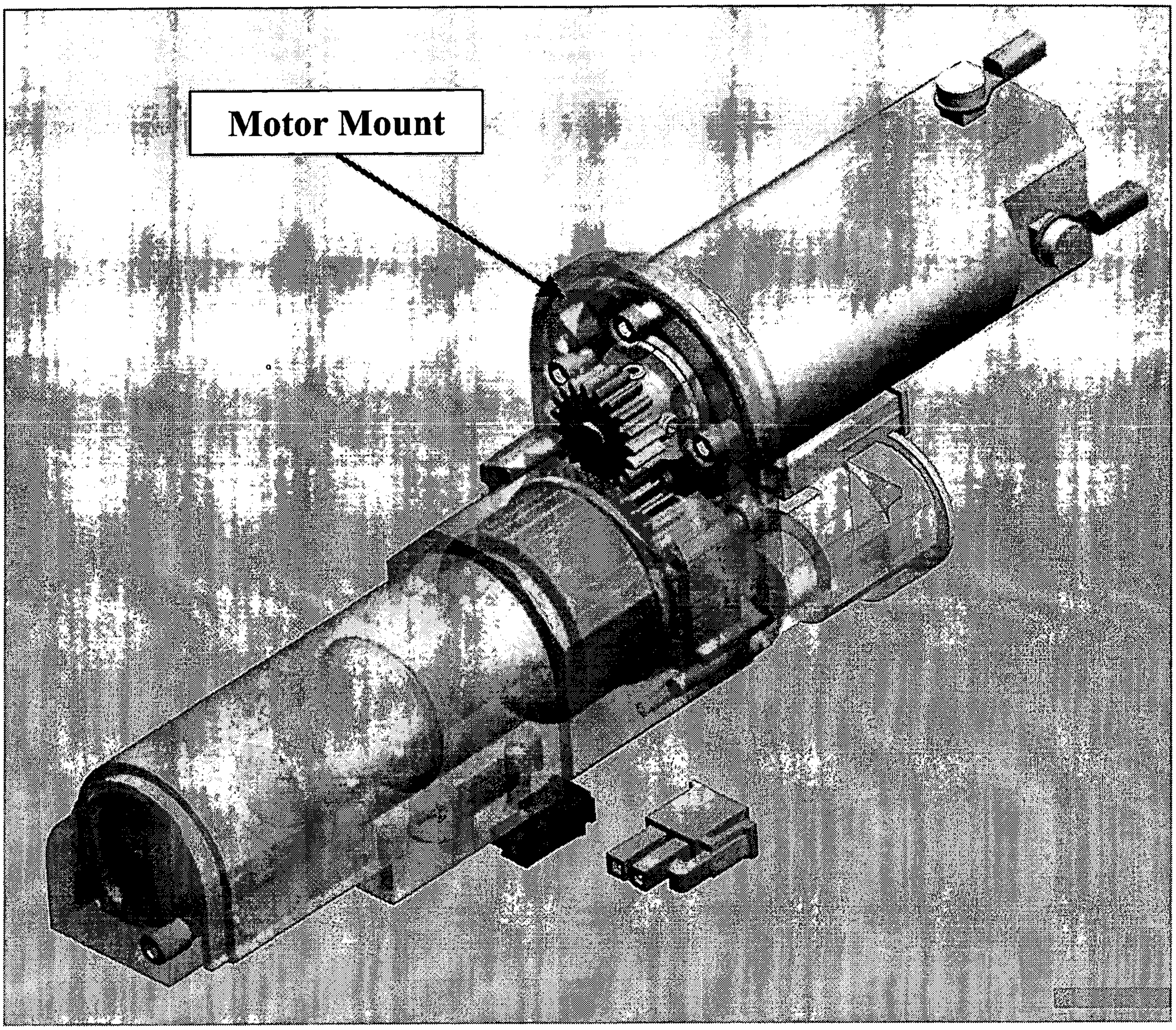


FIG. 13

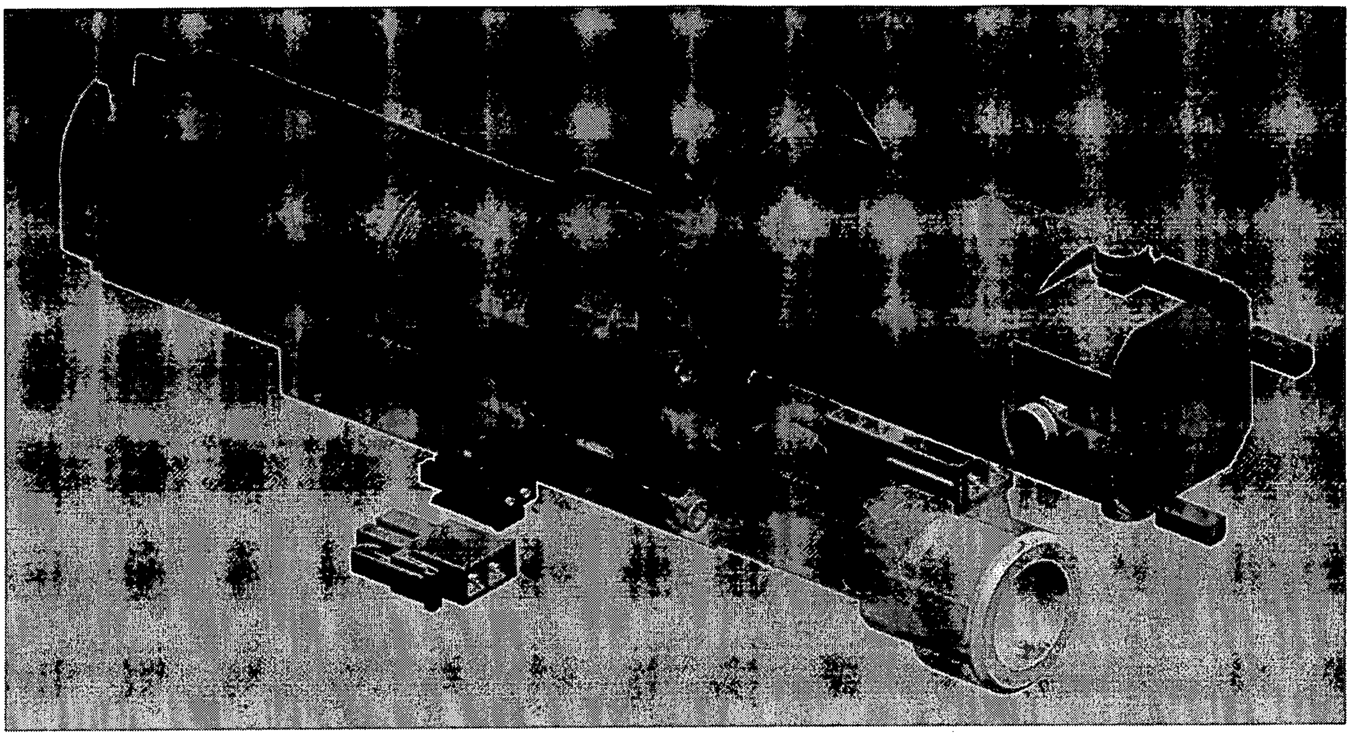


FIG. 14

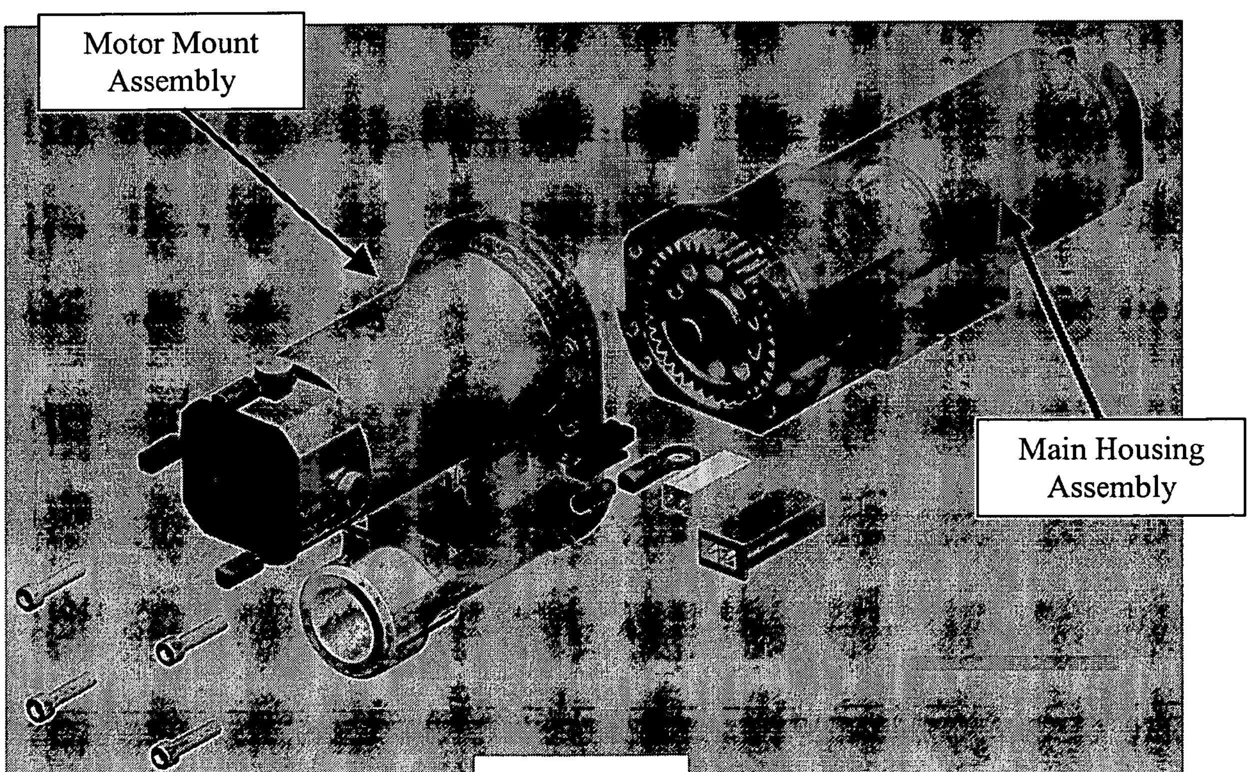


FIG. 15

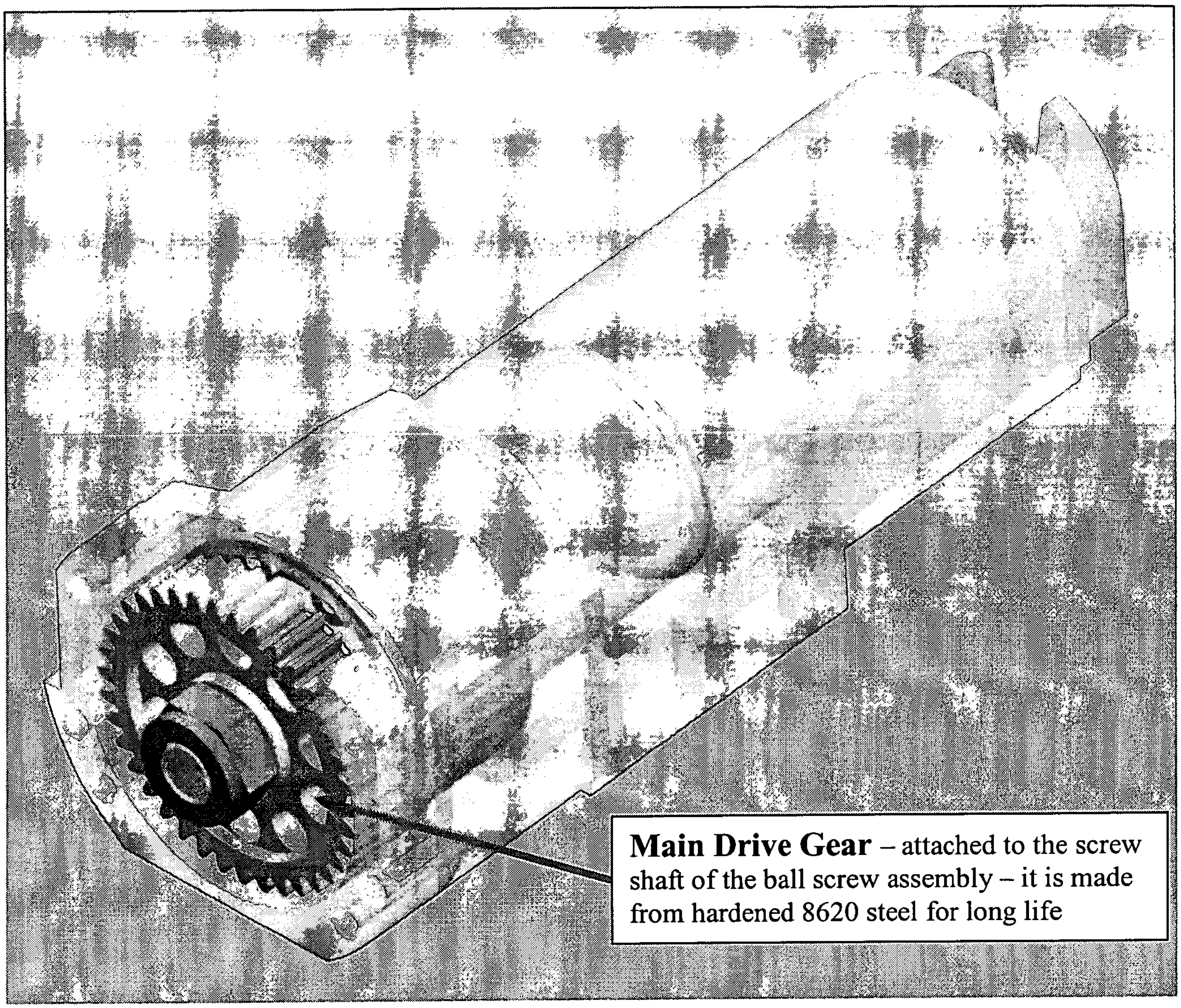

Main Drive Gear – attached to the screw shaft of the ball screw assembly – it is made from hardened 8620 steel for long life

FIG. 16

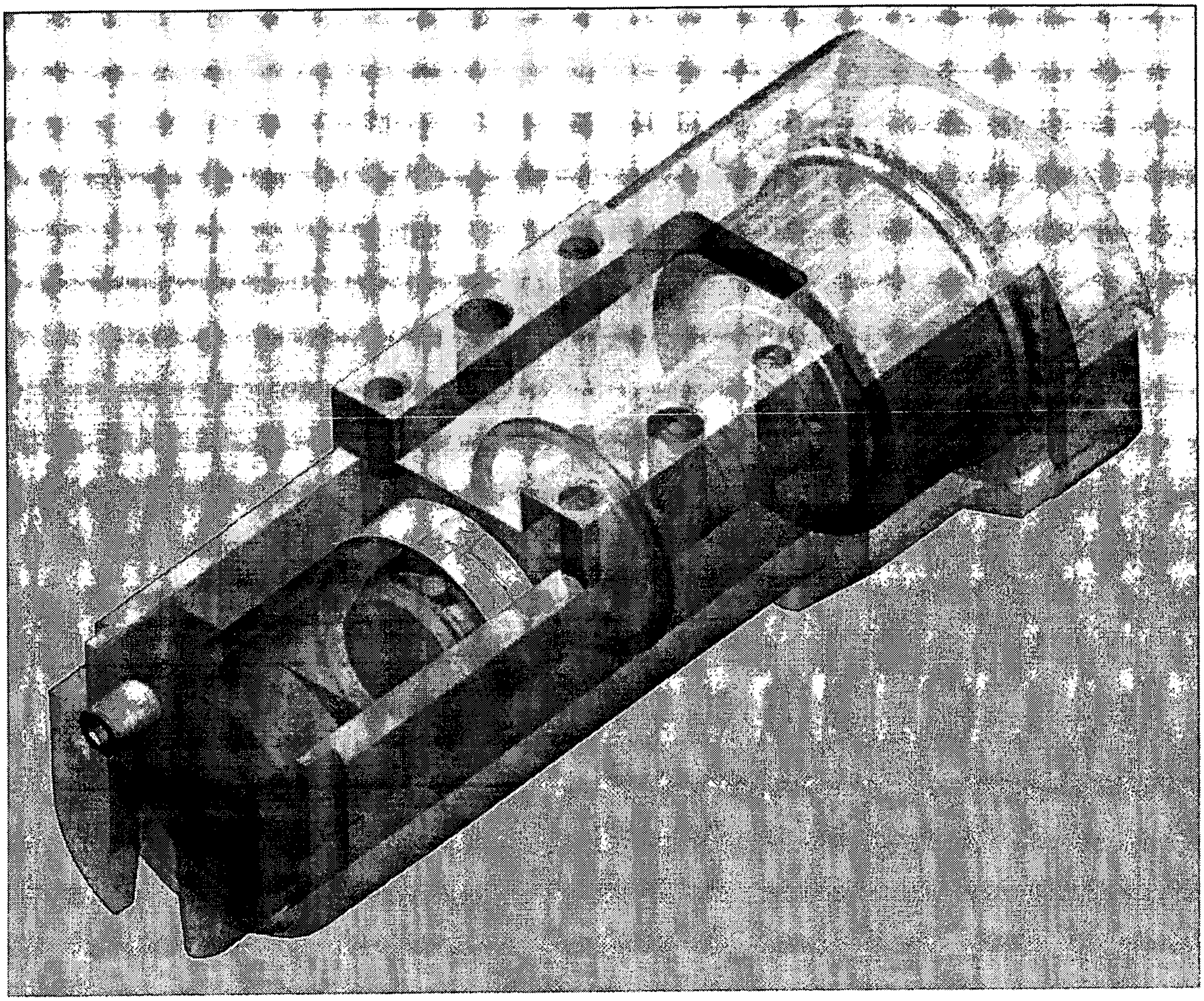


FIG. 17

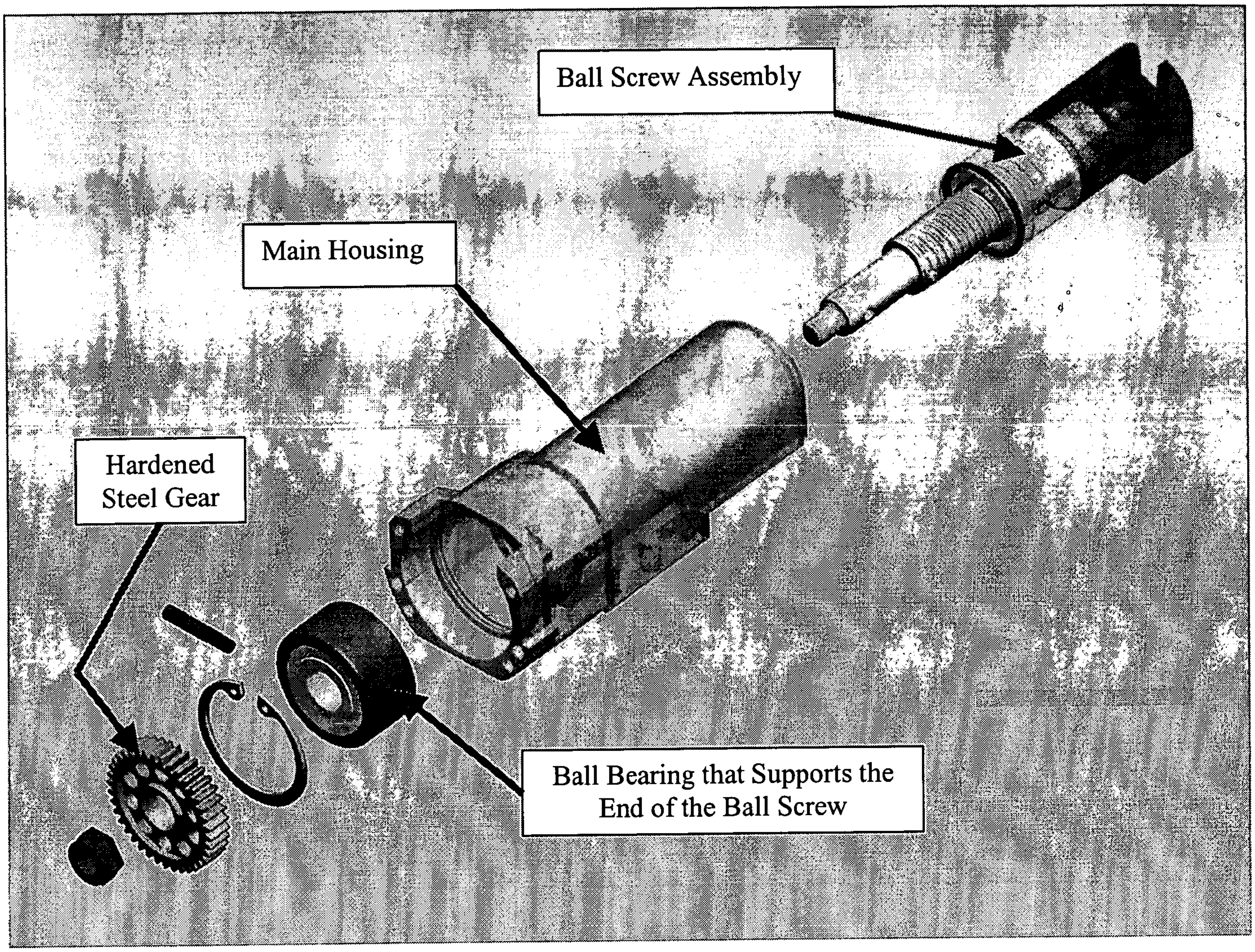

Ball Screw Assembly
Main Housing
Hardened
Steel Gear
Ball Bearing that Supports the
End of the Ball Screw

FIG. 18

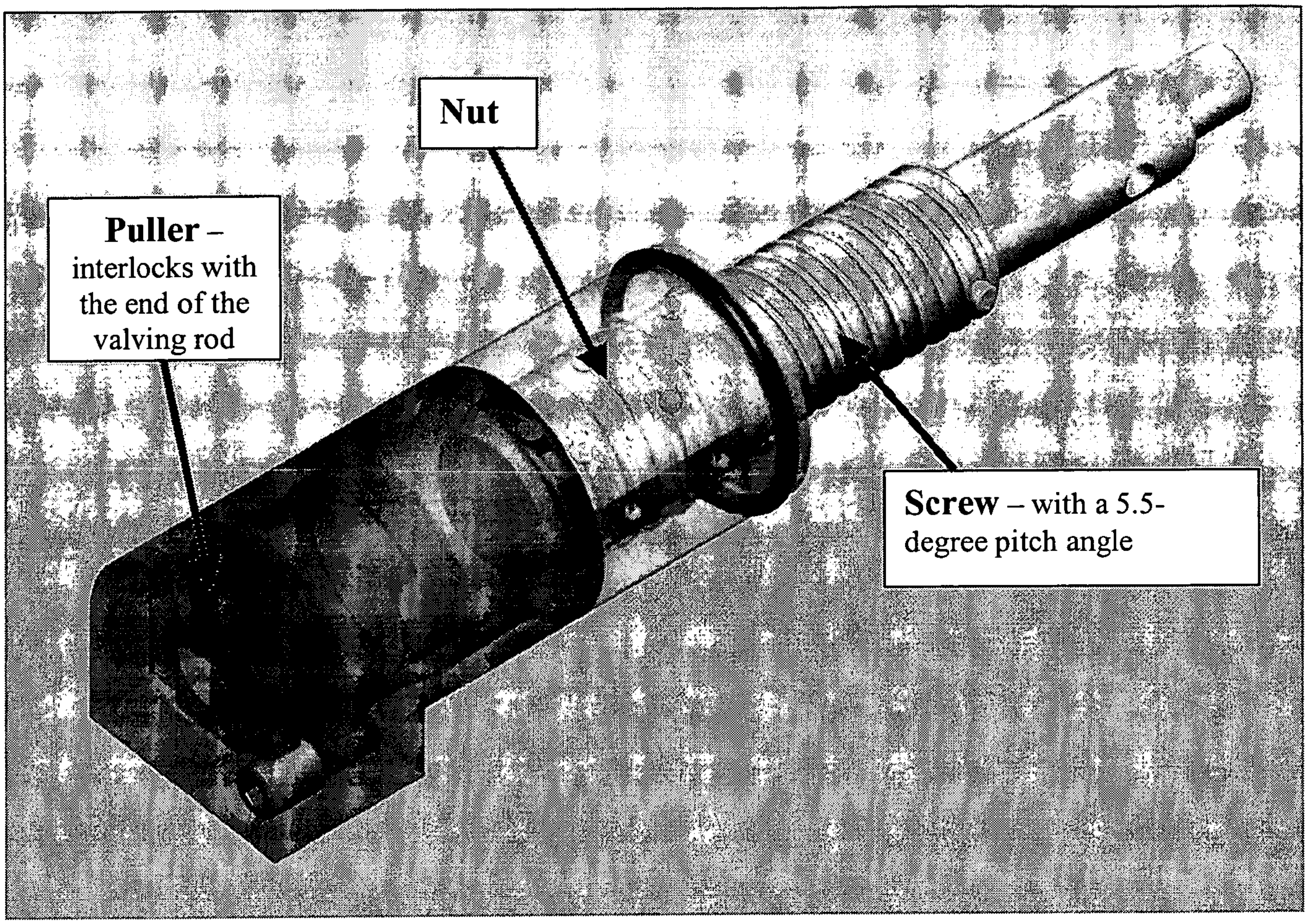

Nut
Puller – interlocks with the end of the valving rod
Screw – with a 5.5-degree pitch angle

FIG. 19

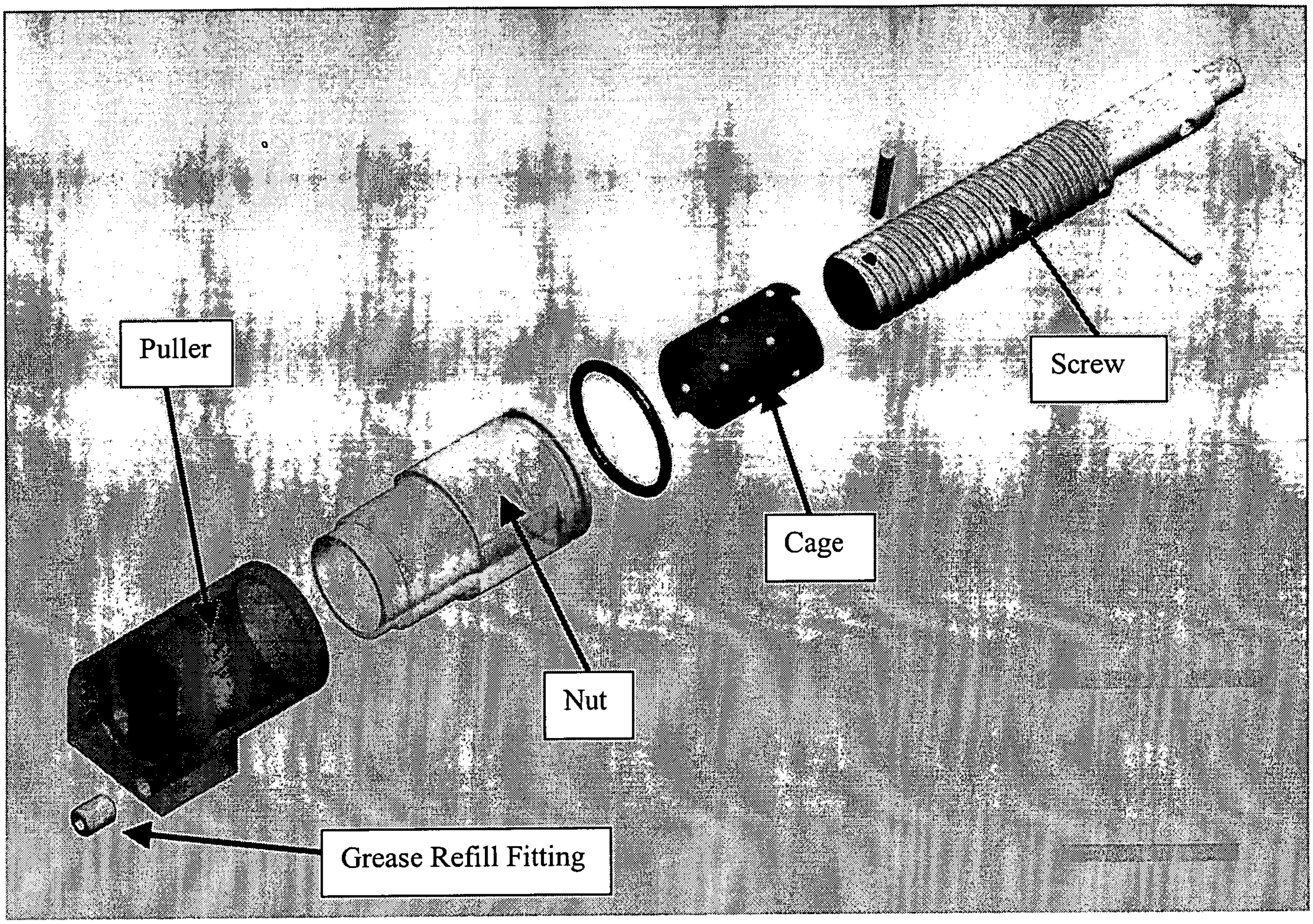


FIG. 20

Two Views of the Motor Mount Assembly

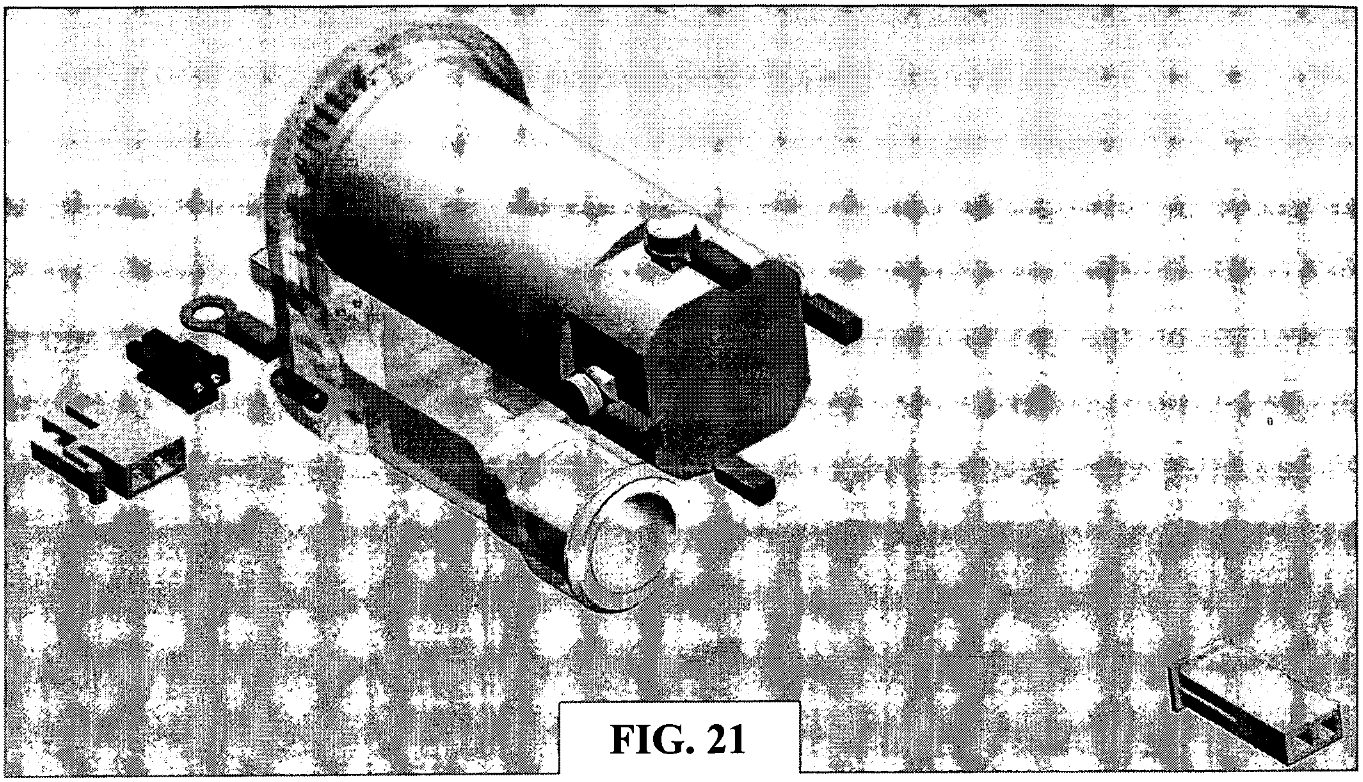


FIG. 21

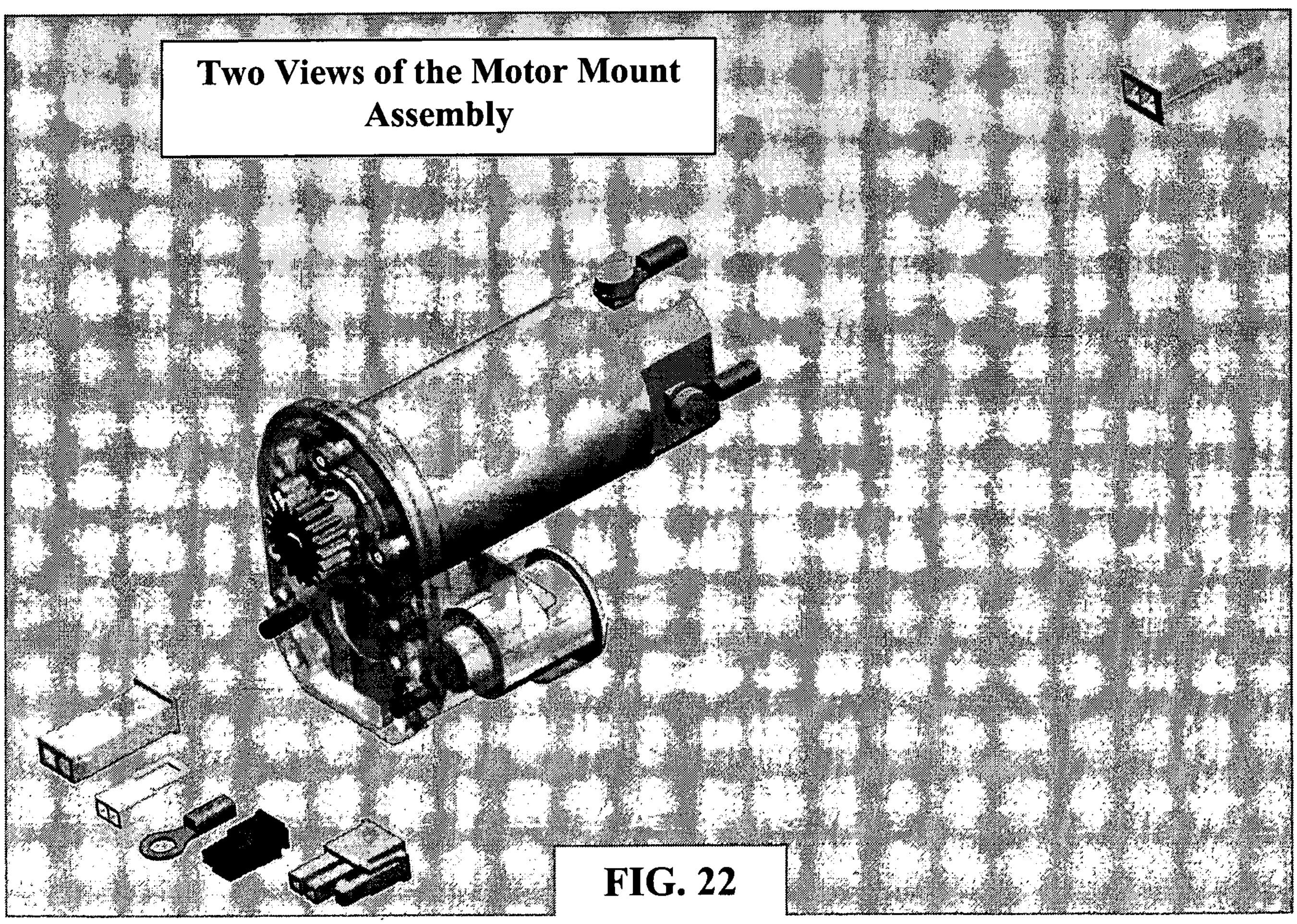


FIG. 22

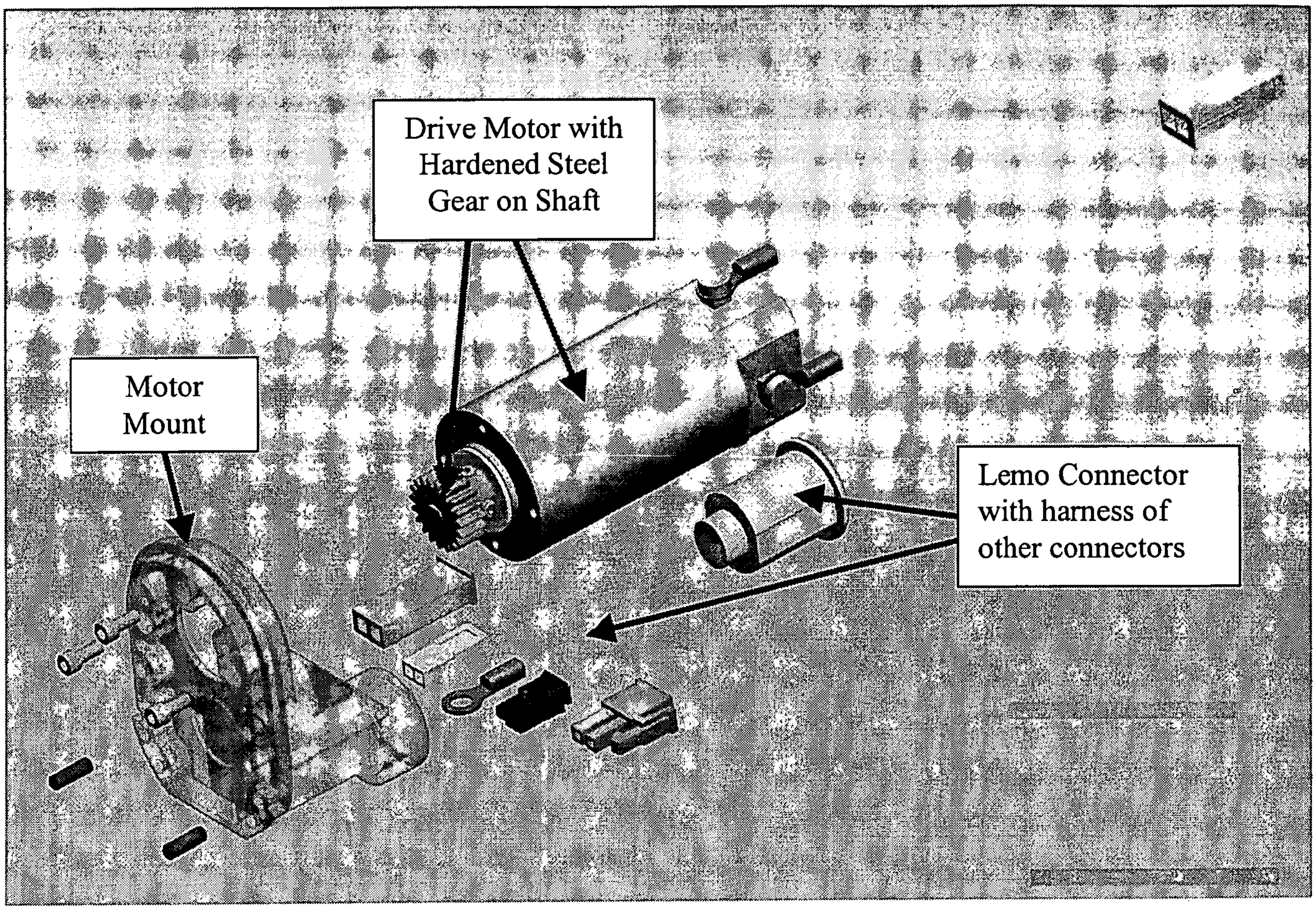

Drive Motor with
Hardened Steel
Gear on Shaft
Motor
Mount
Lemo Connector
with harness of
other connectors

FIG. 23

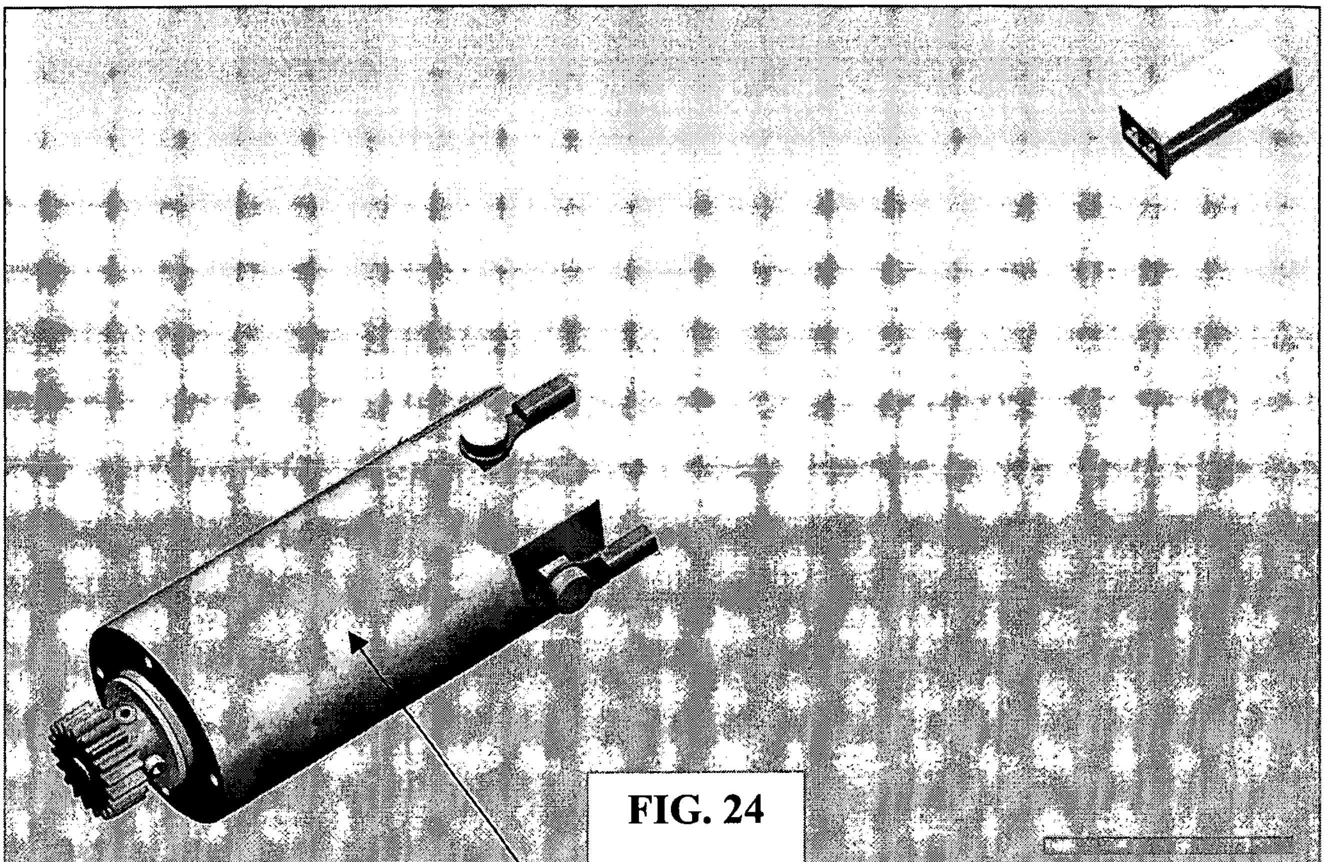

Two Views of the Motor Assembly

FIG. 24

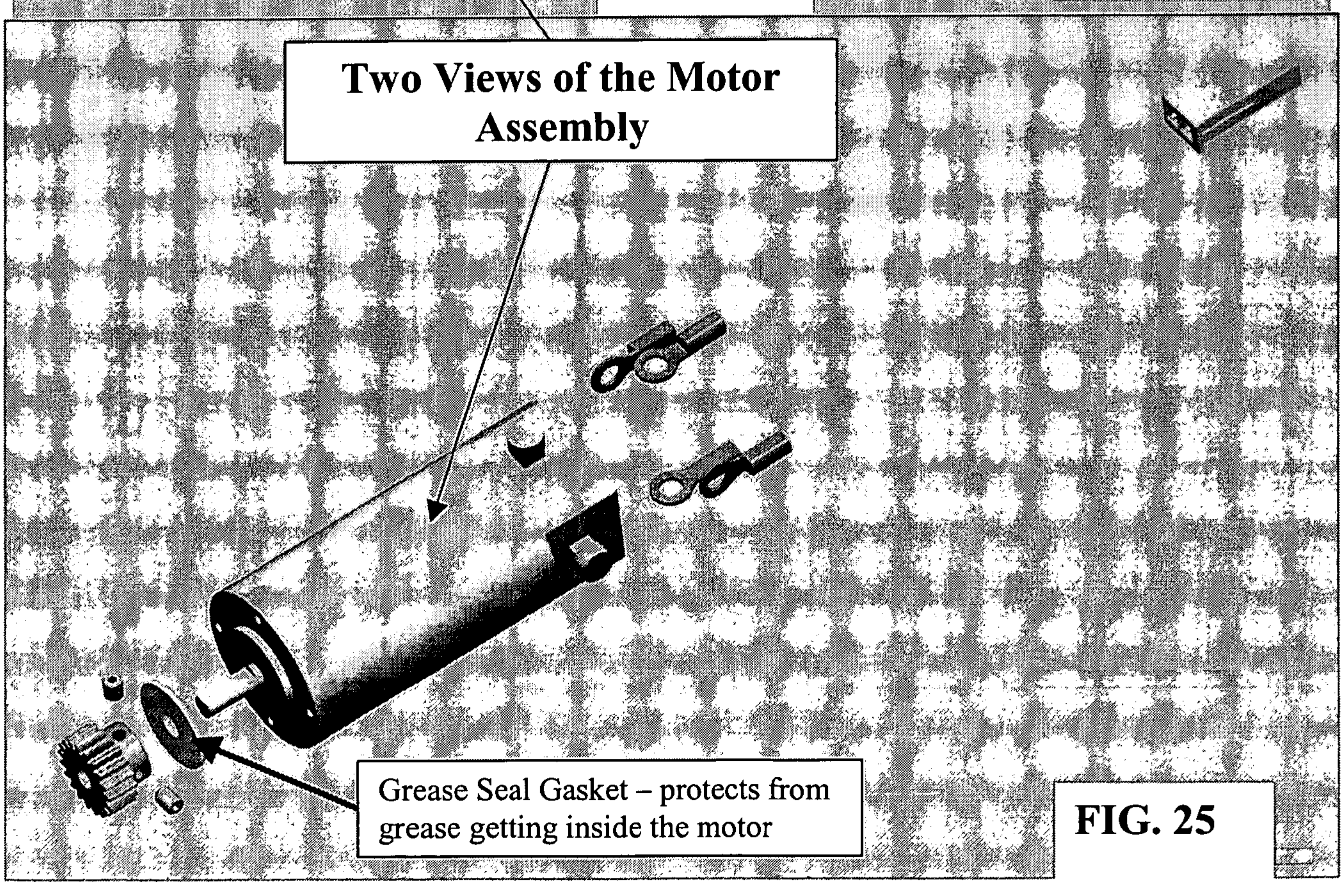

Grease Seal Gasket – protects from grease getting inside the motor

FIG. 25

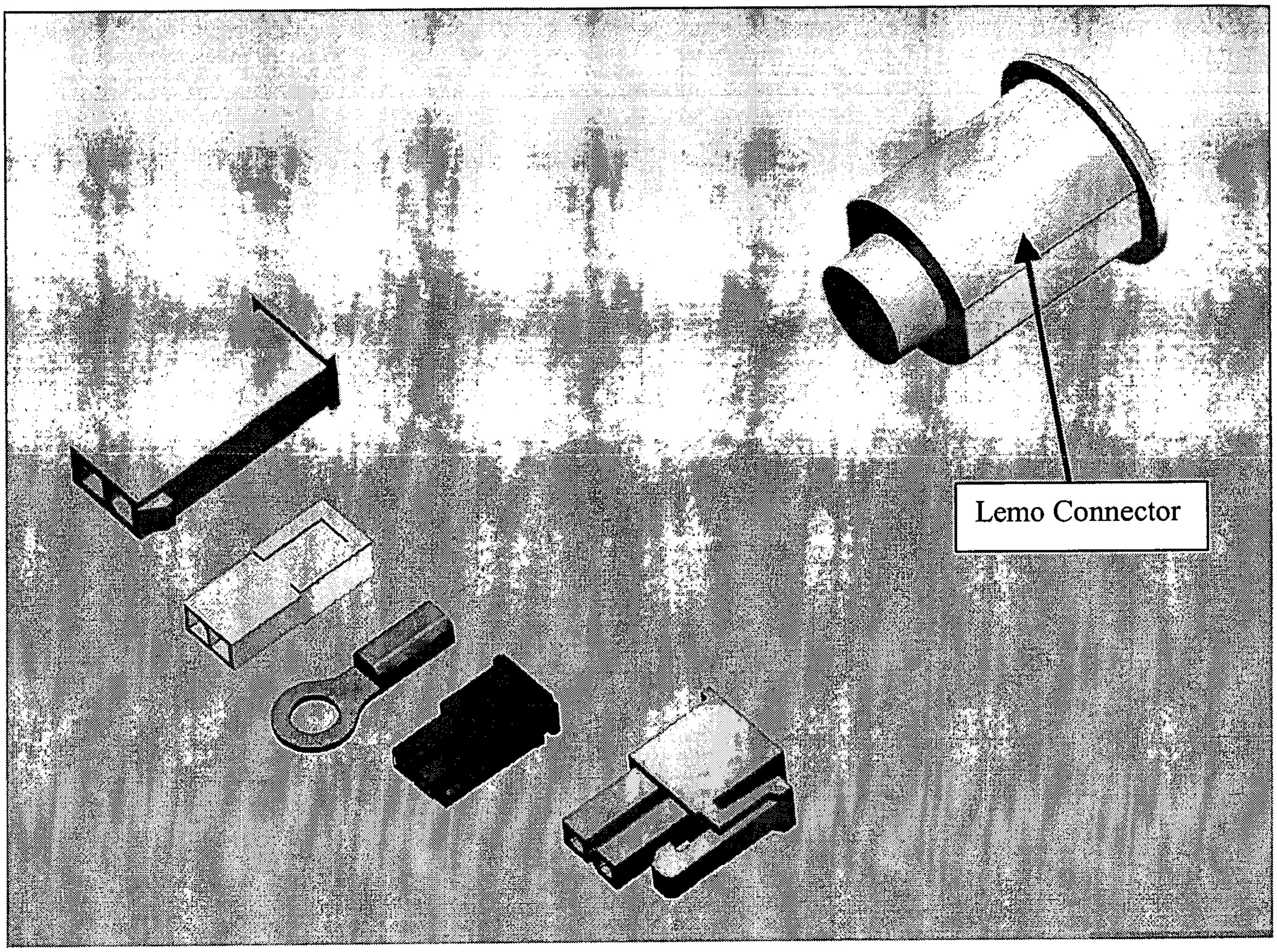


FIG. 26

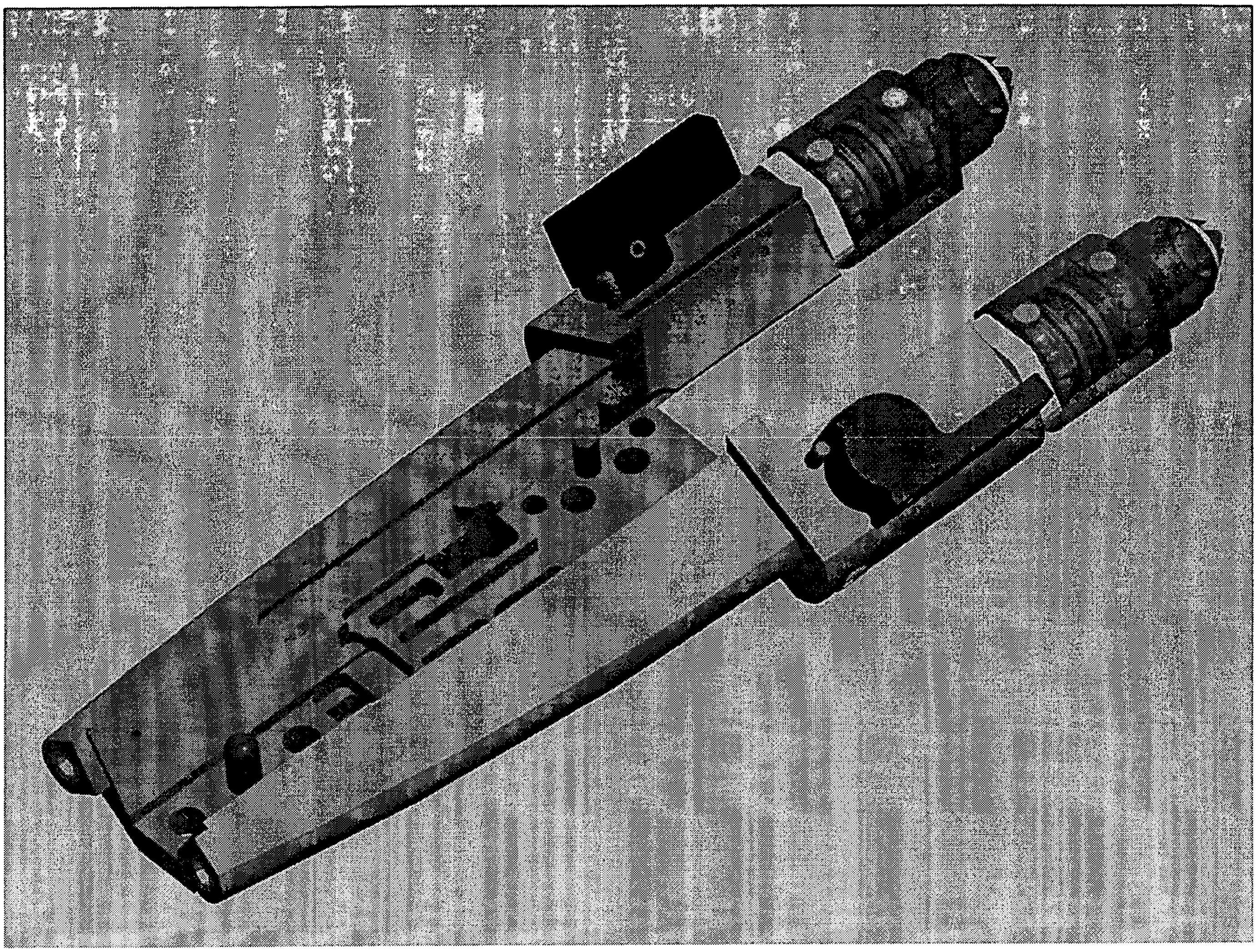


FIG. 27

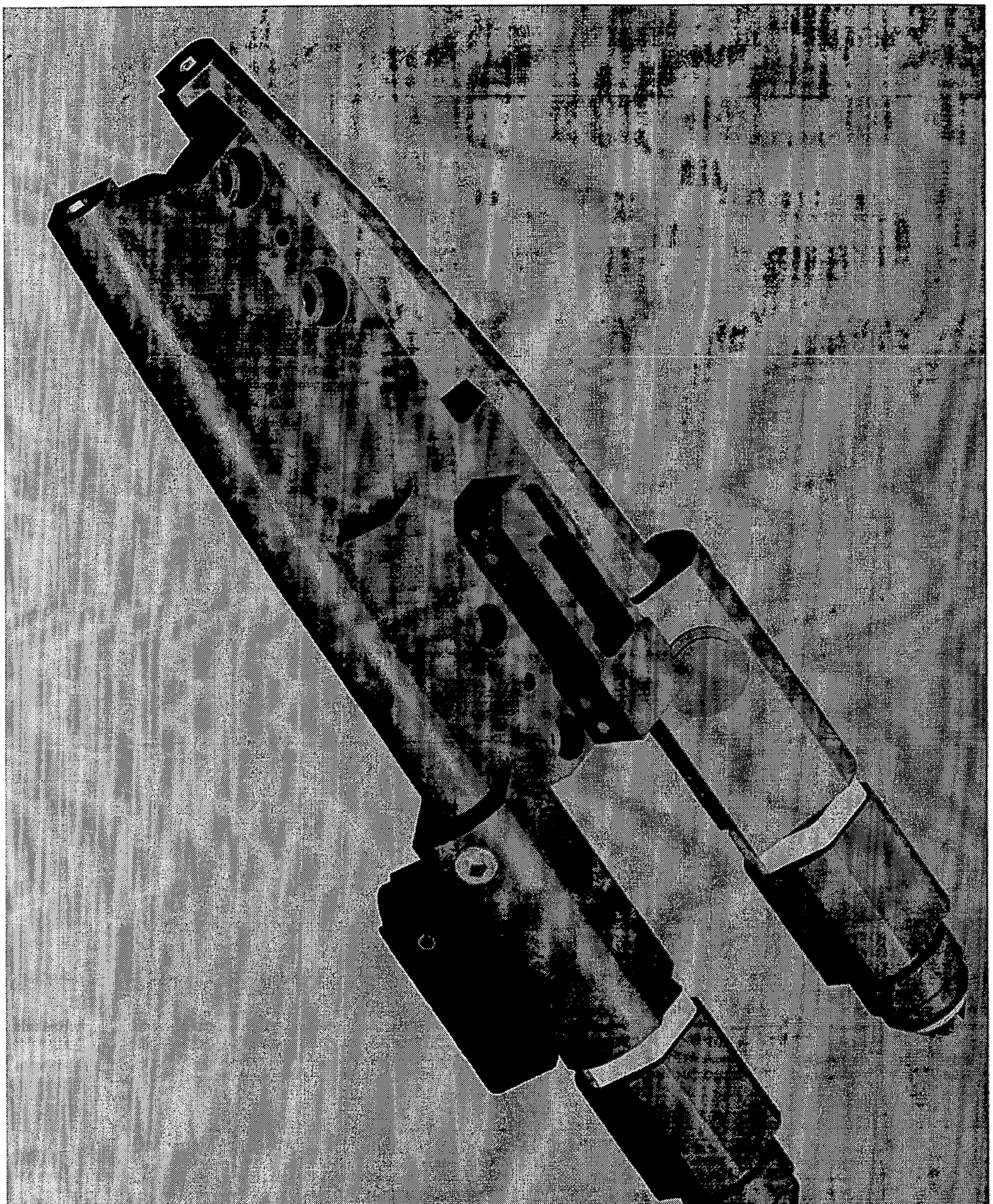


FIG. 28

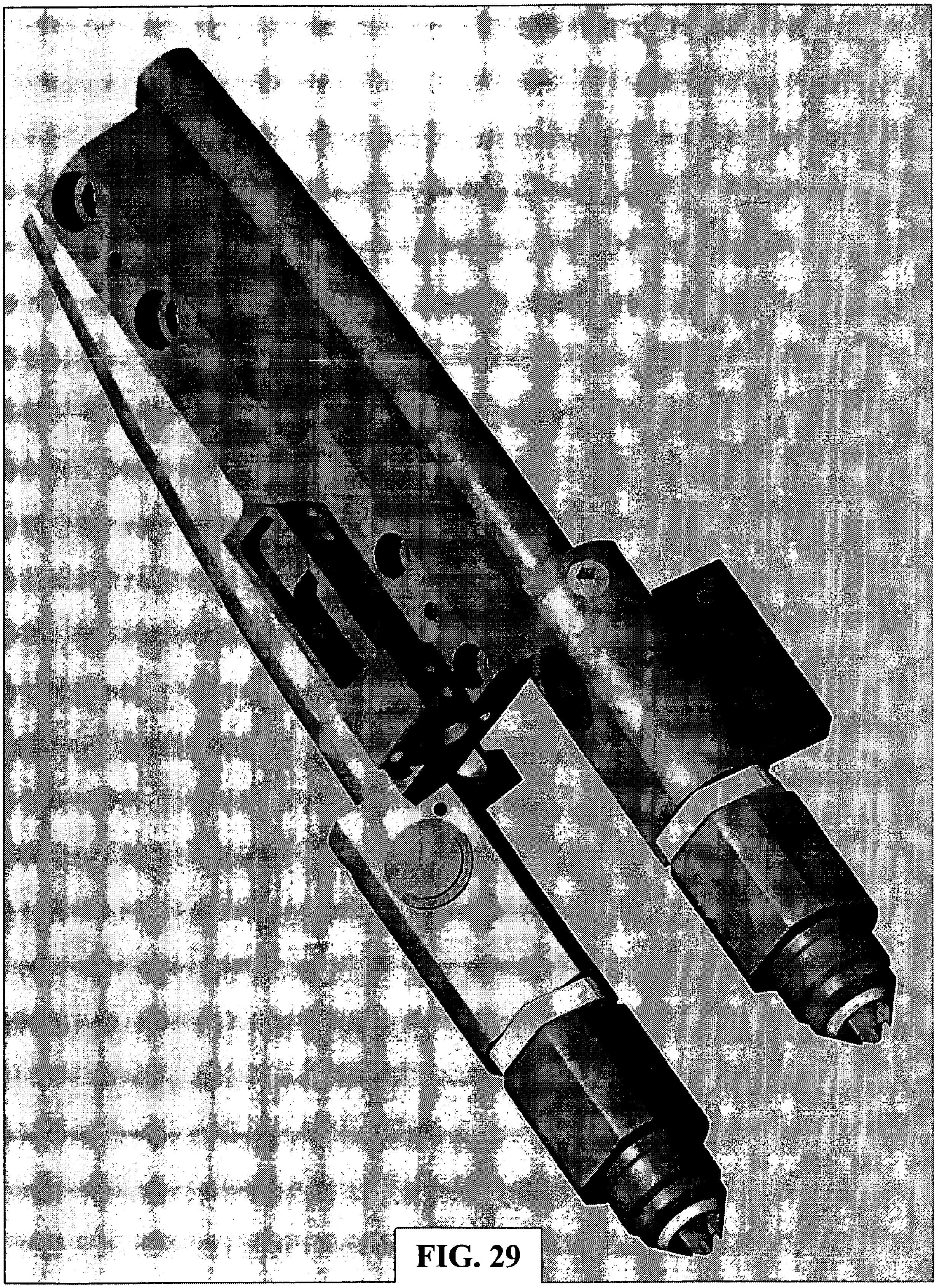


FIG. 29

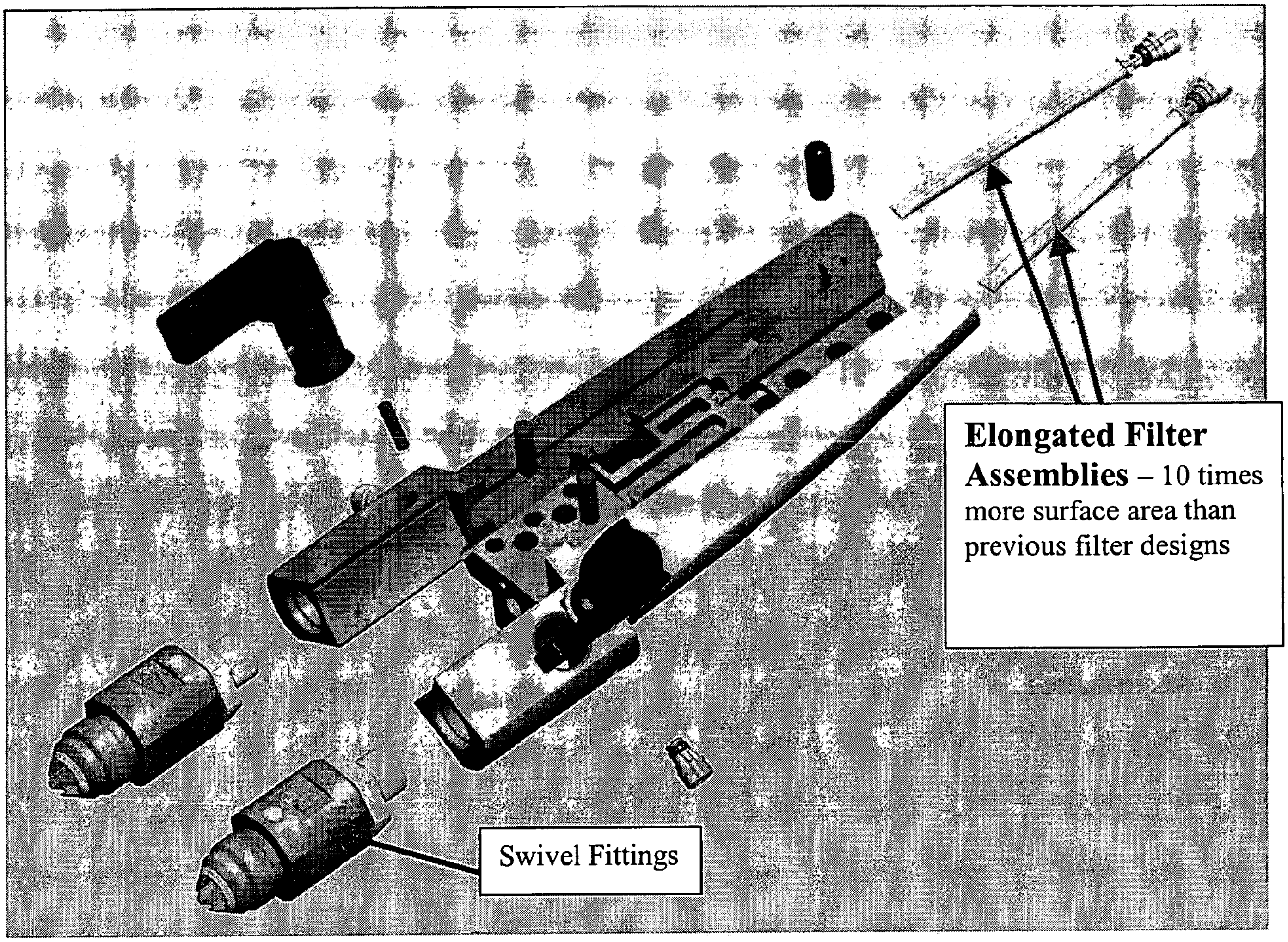

Elongated Filter Assemblies – 10 times more surface area than previous filter designs
Swivel Fittings

FIG. 30

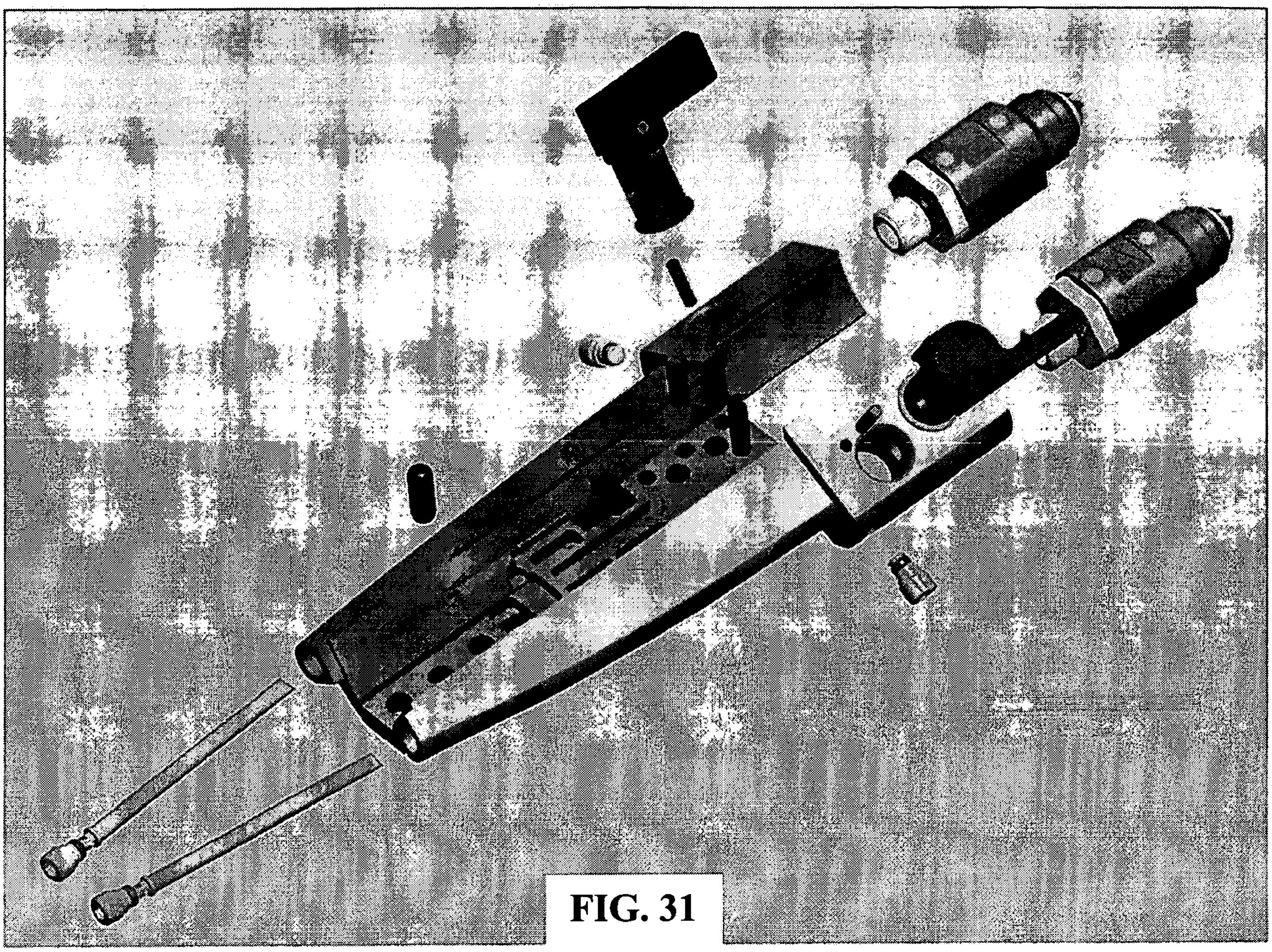


FIG. 31

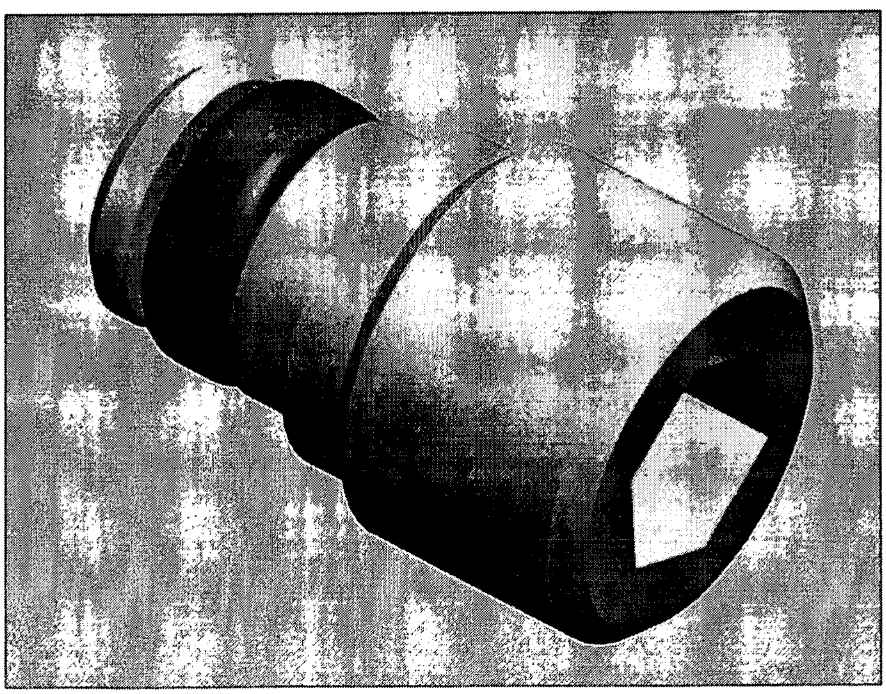


FIG. 32

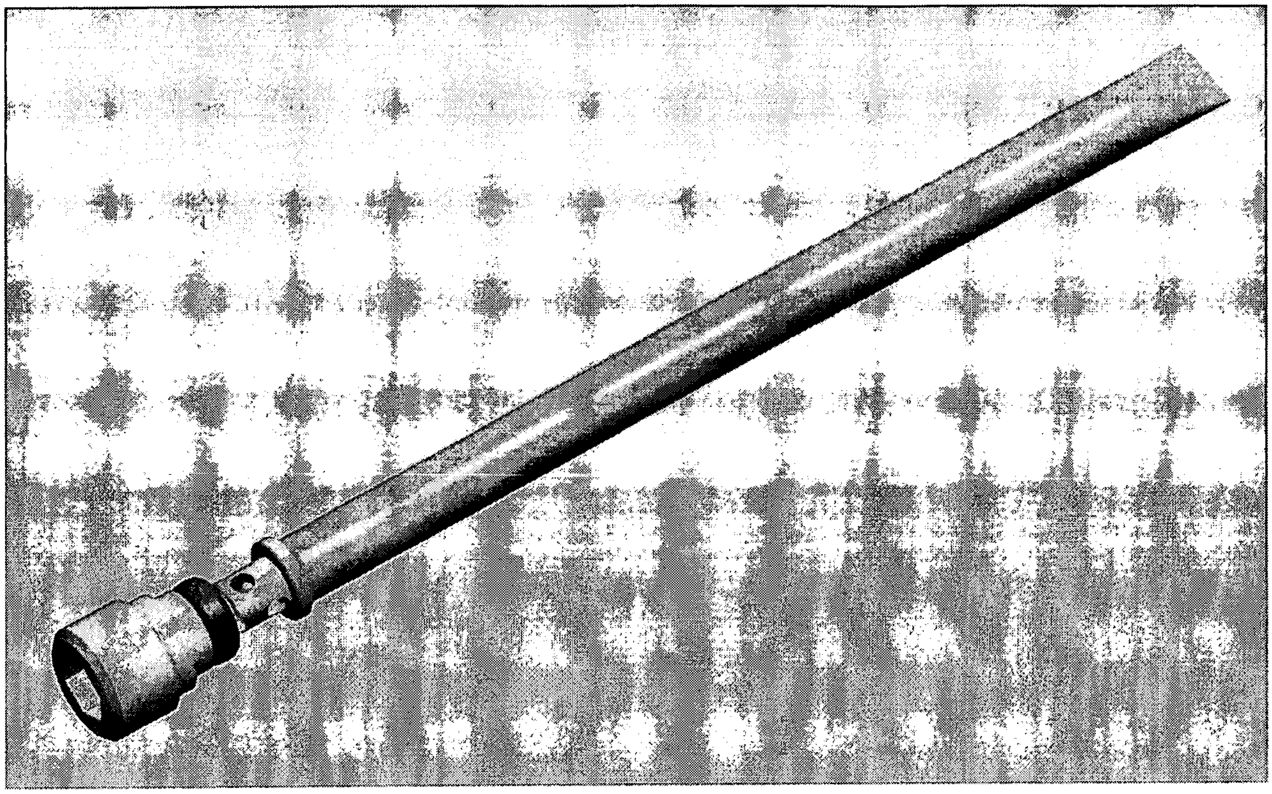


FIG. 33

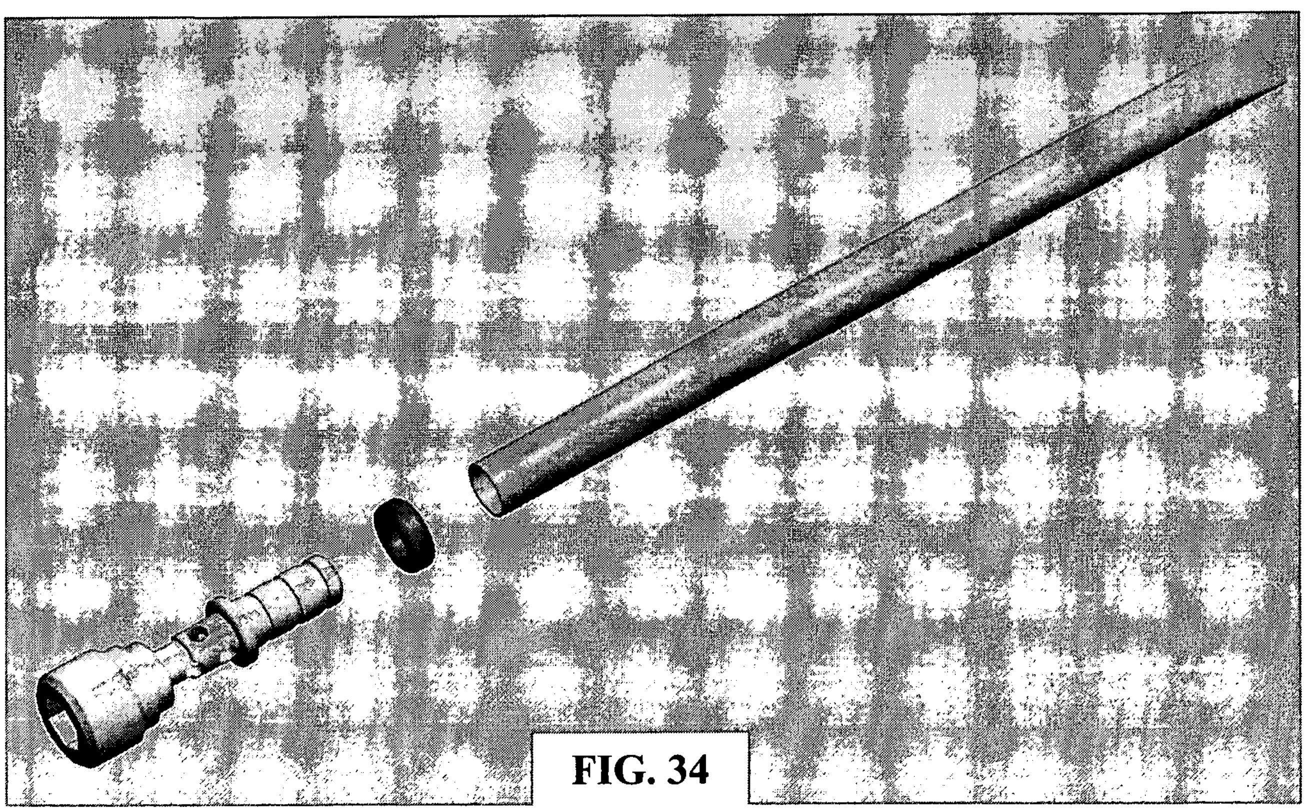


FIG. 34

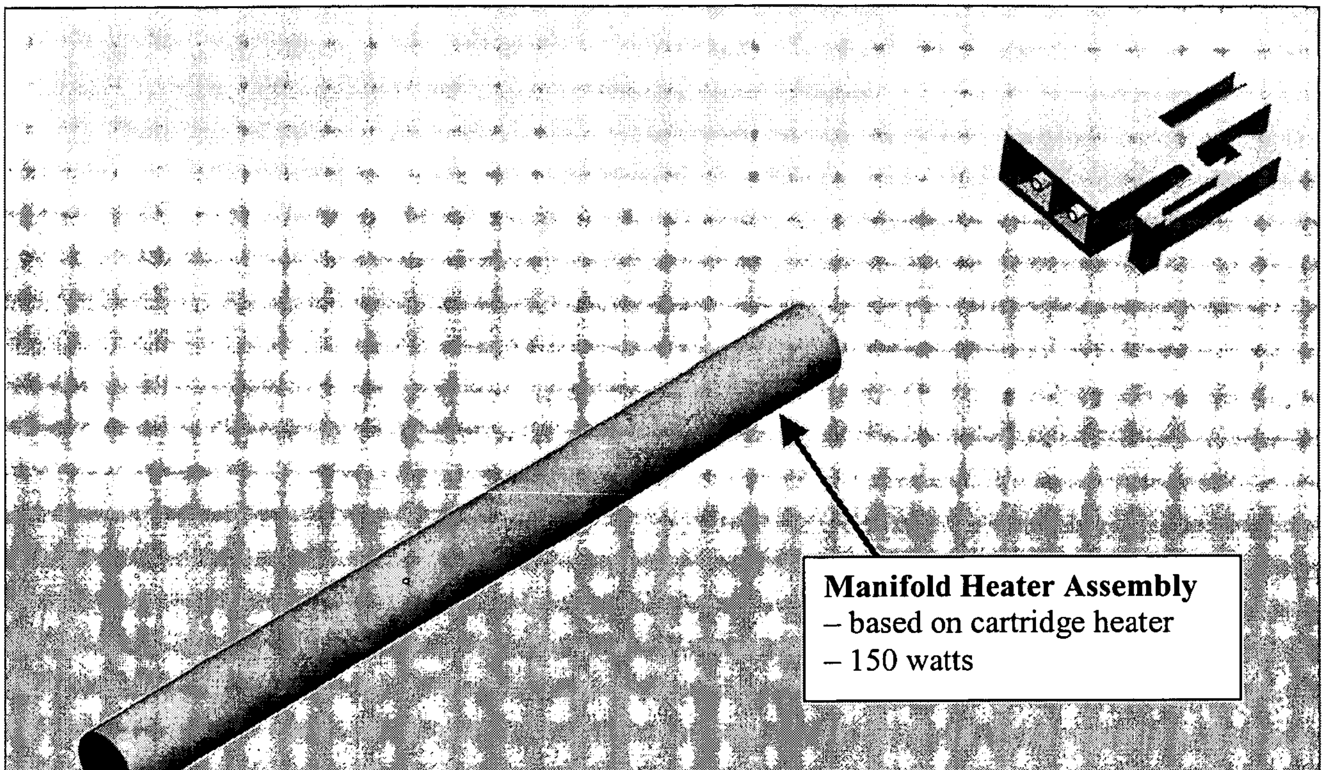

Manifold Heater Assembly
– based on cartridge heater
– 150 watts

FIG. 35

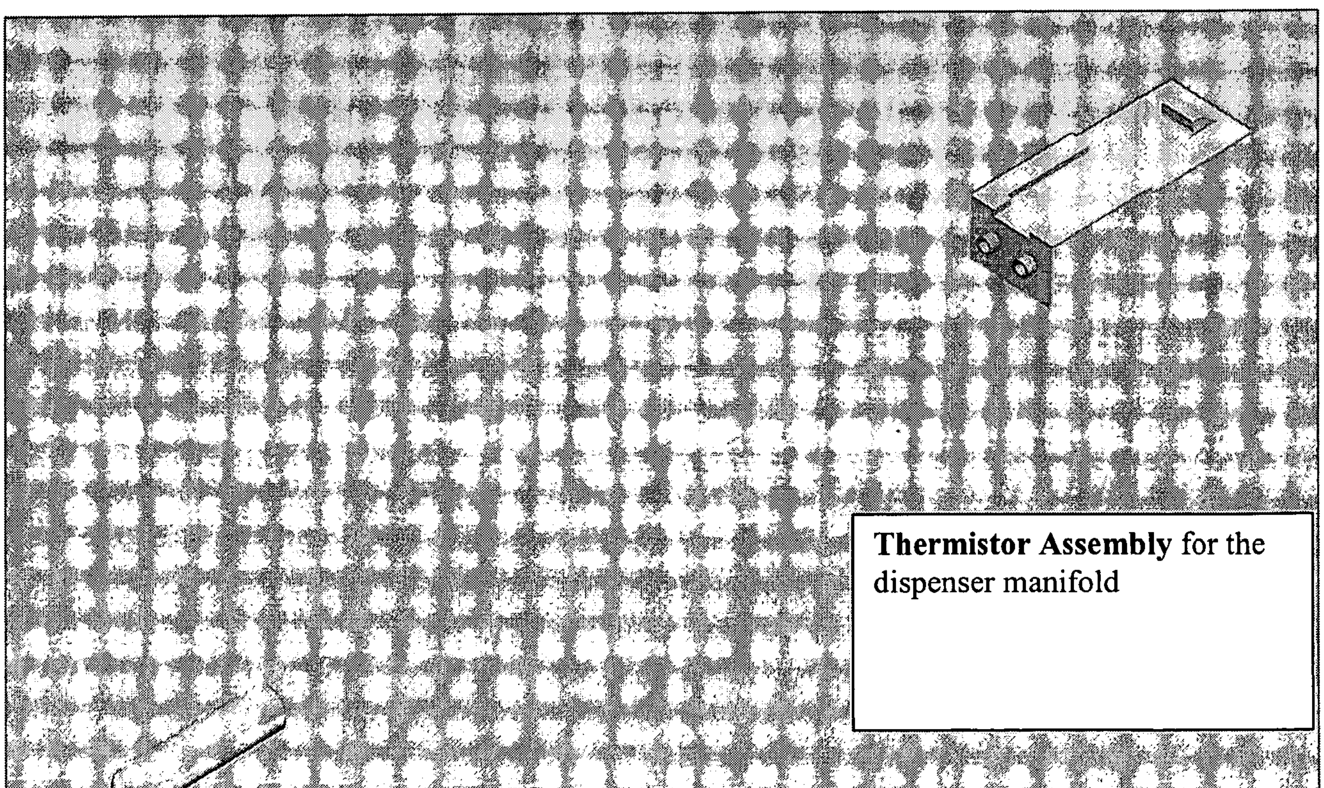

Thermistor Assembly for the dispenser manifold

FIG. 36

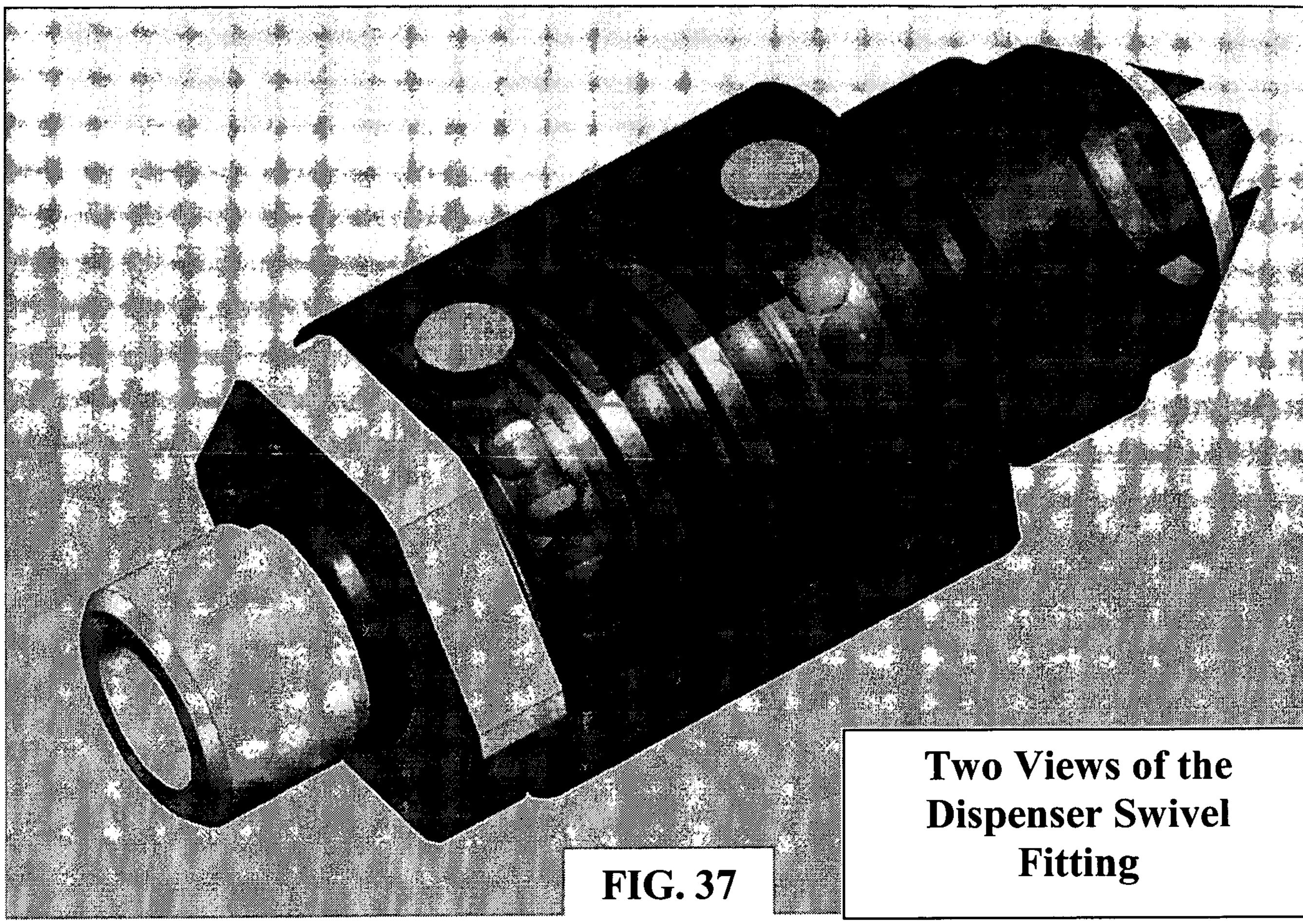


FIG. 37

Two Views of the Dispenser Swivel Fitting

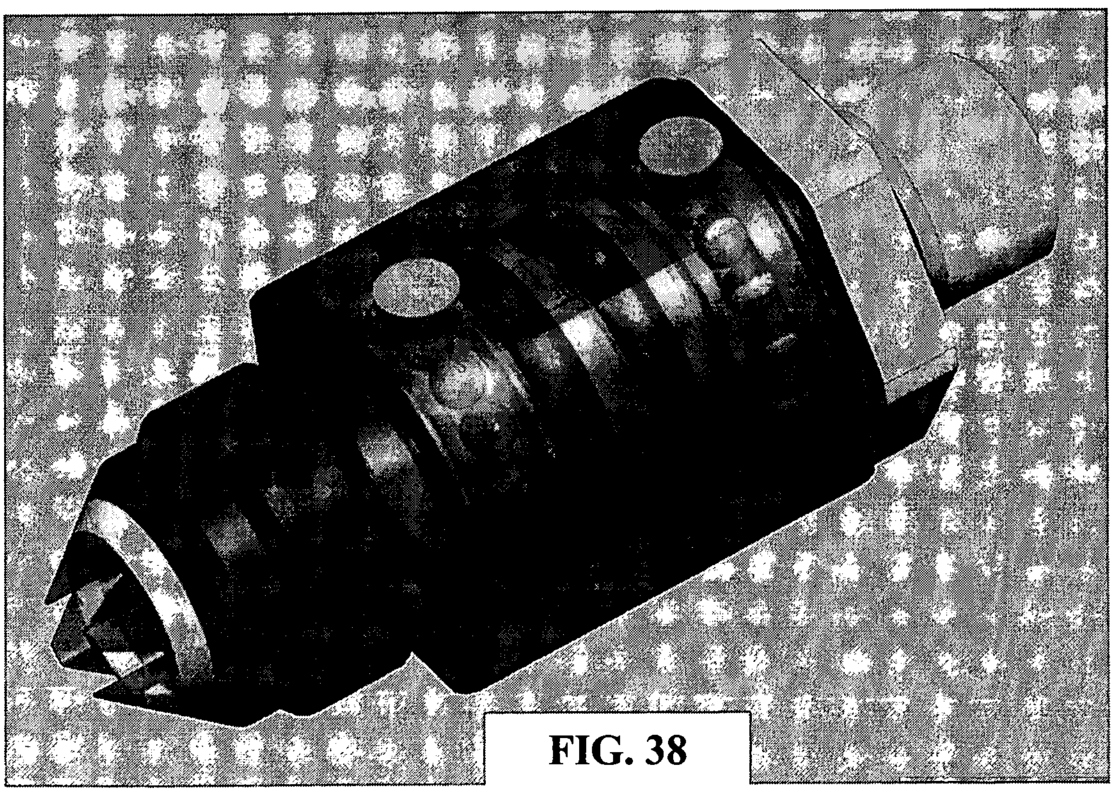


FIG. 38

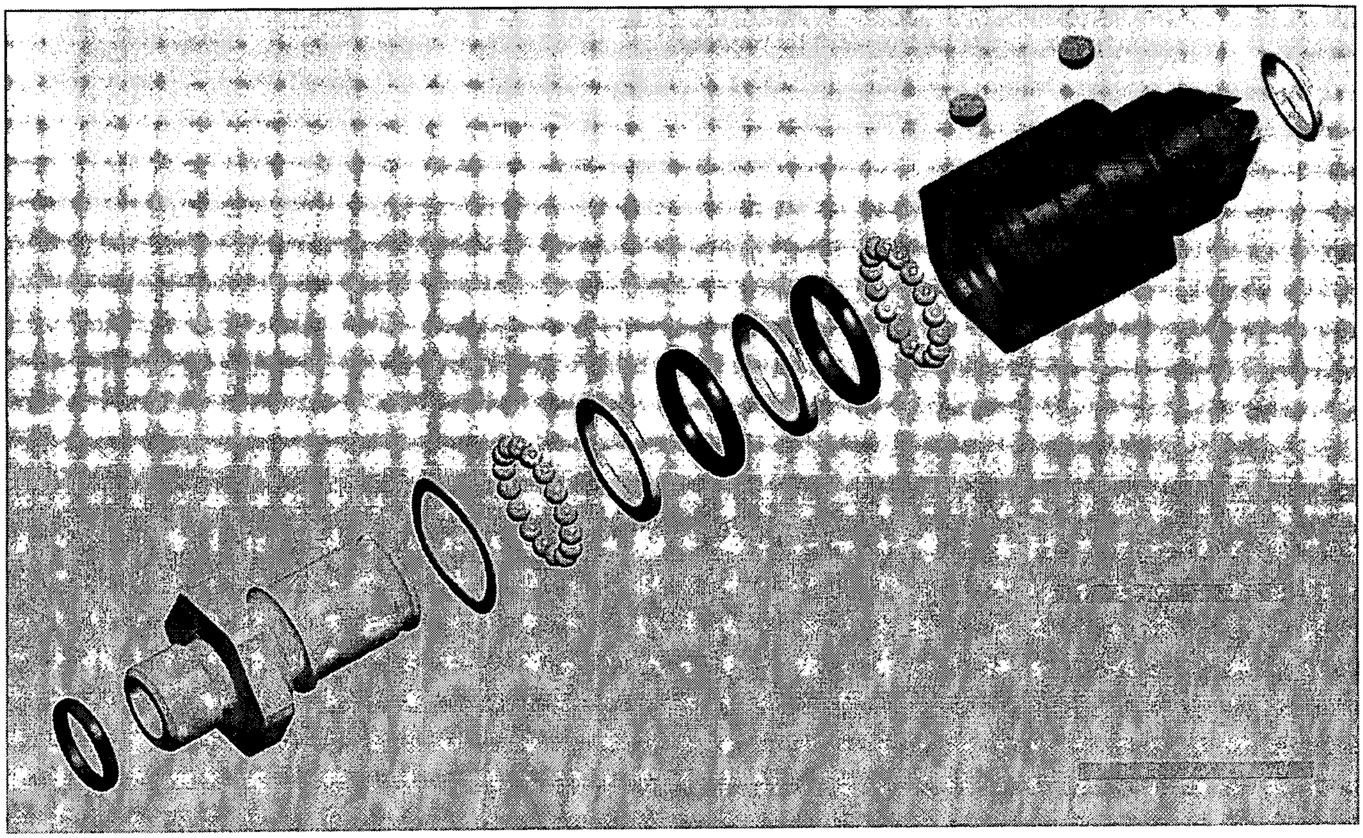


FIG. 39

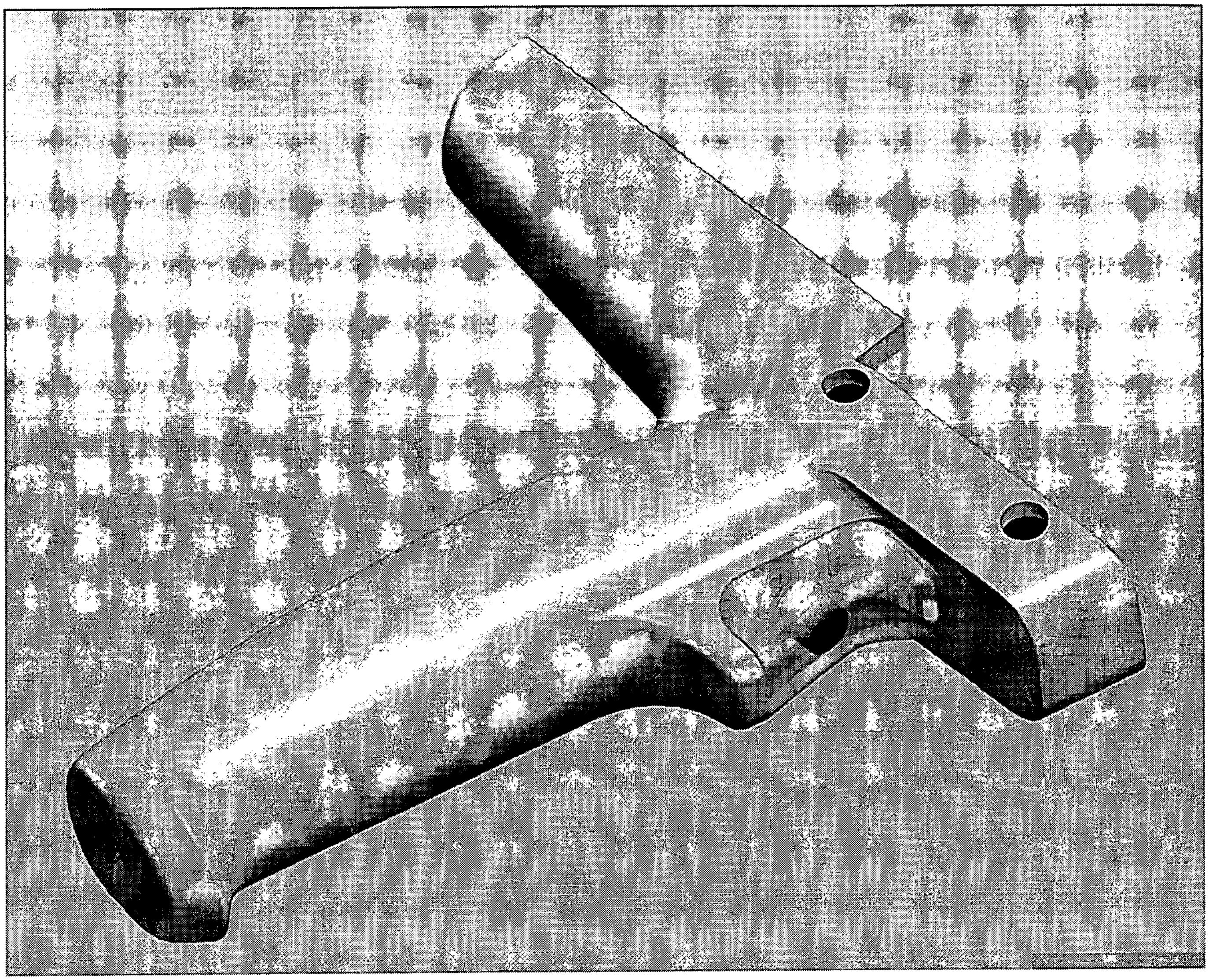


FIG. 40

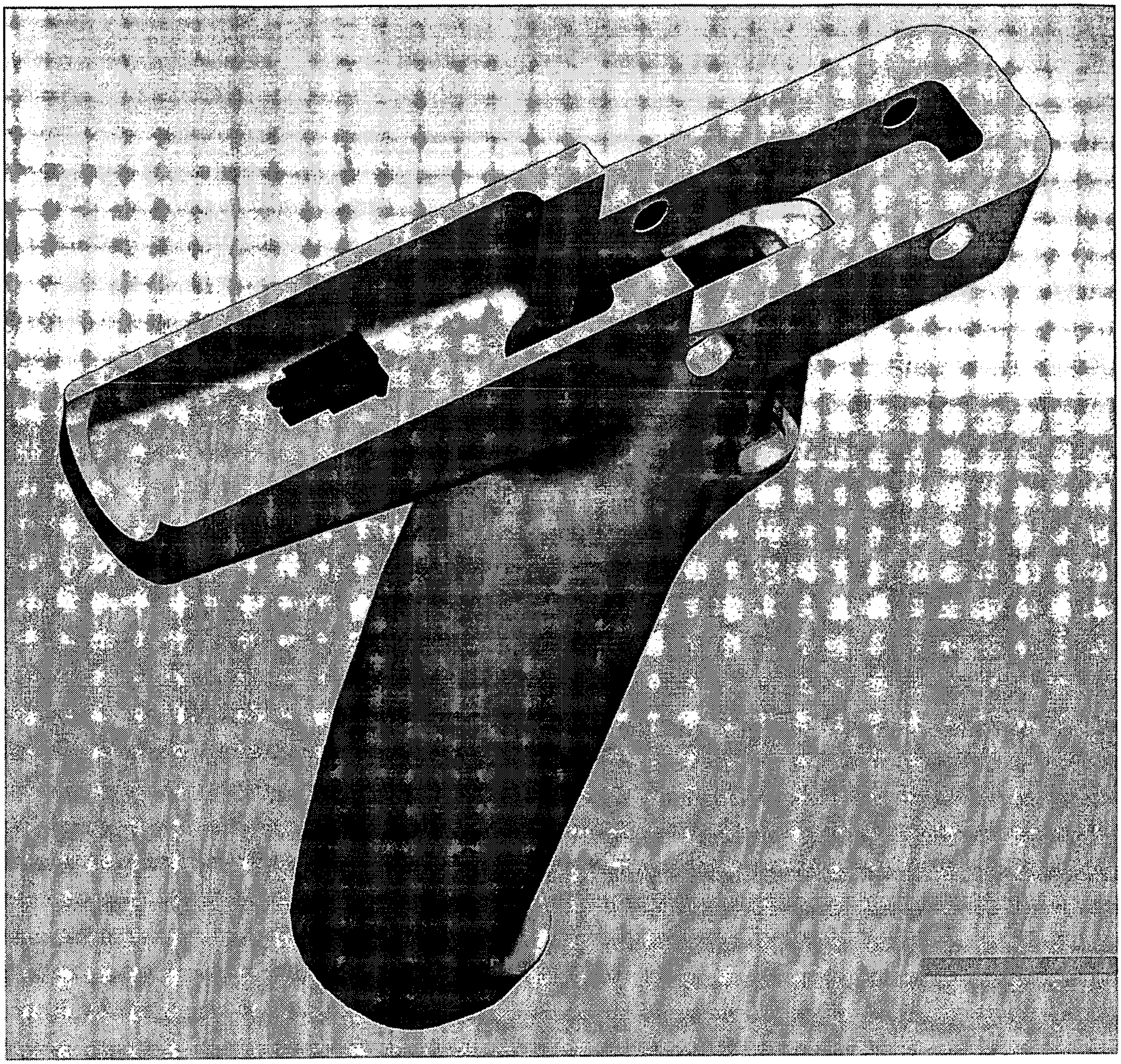


FIG. 41

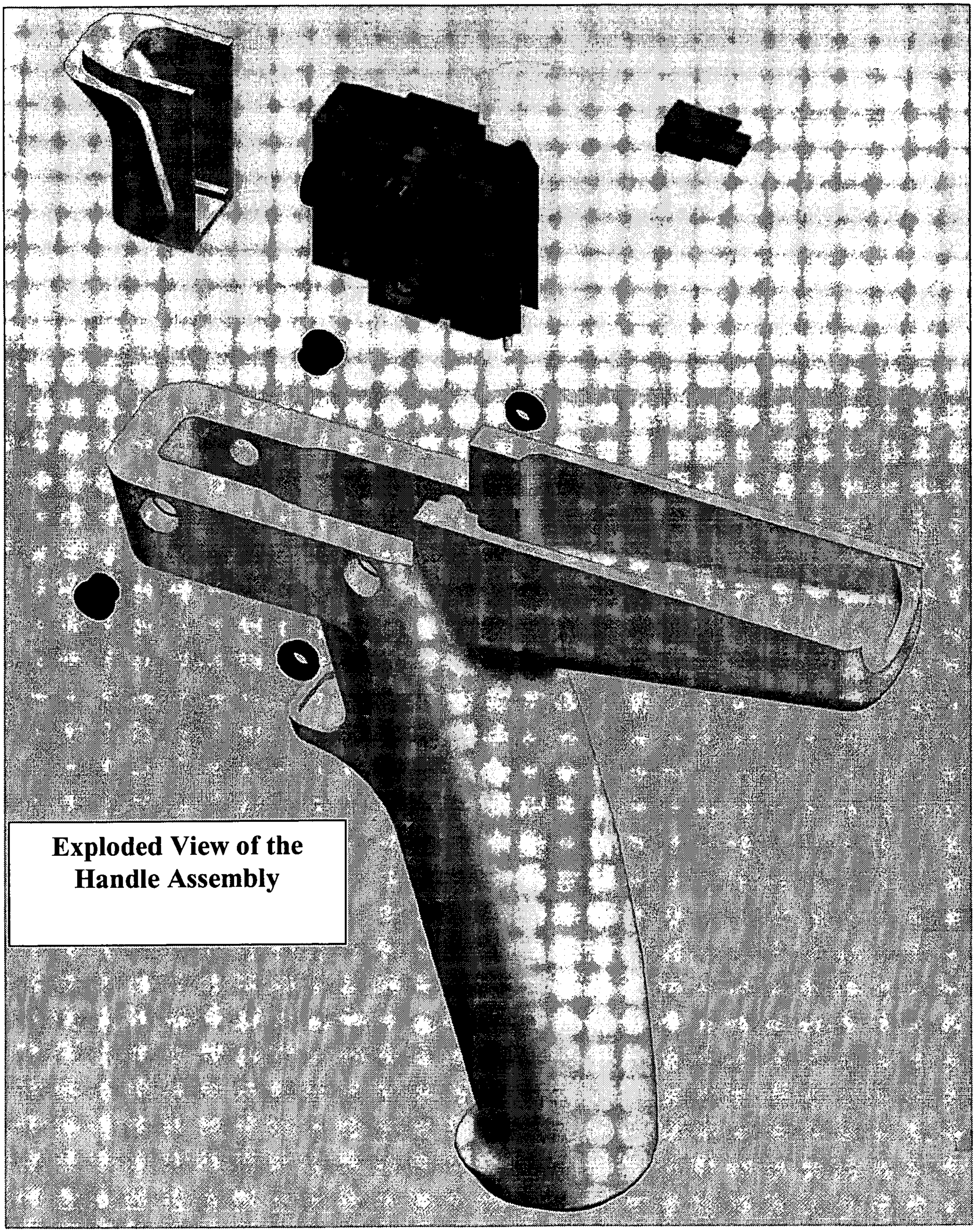


FIG. 42

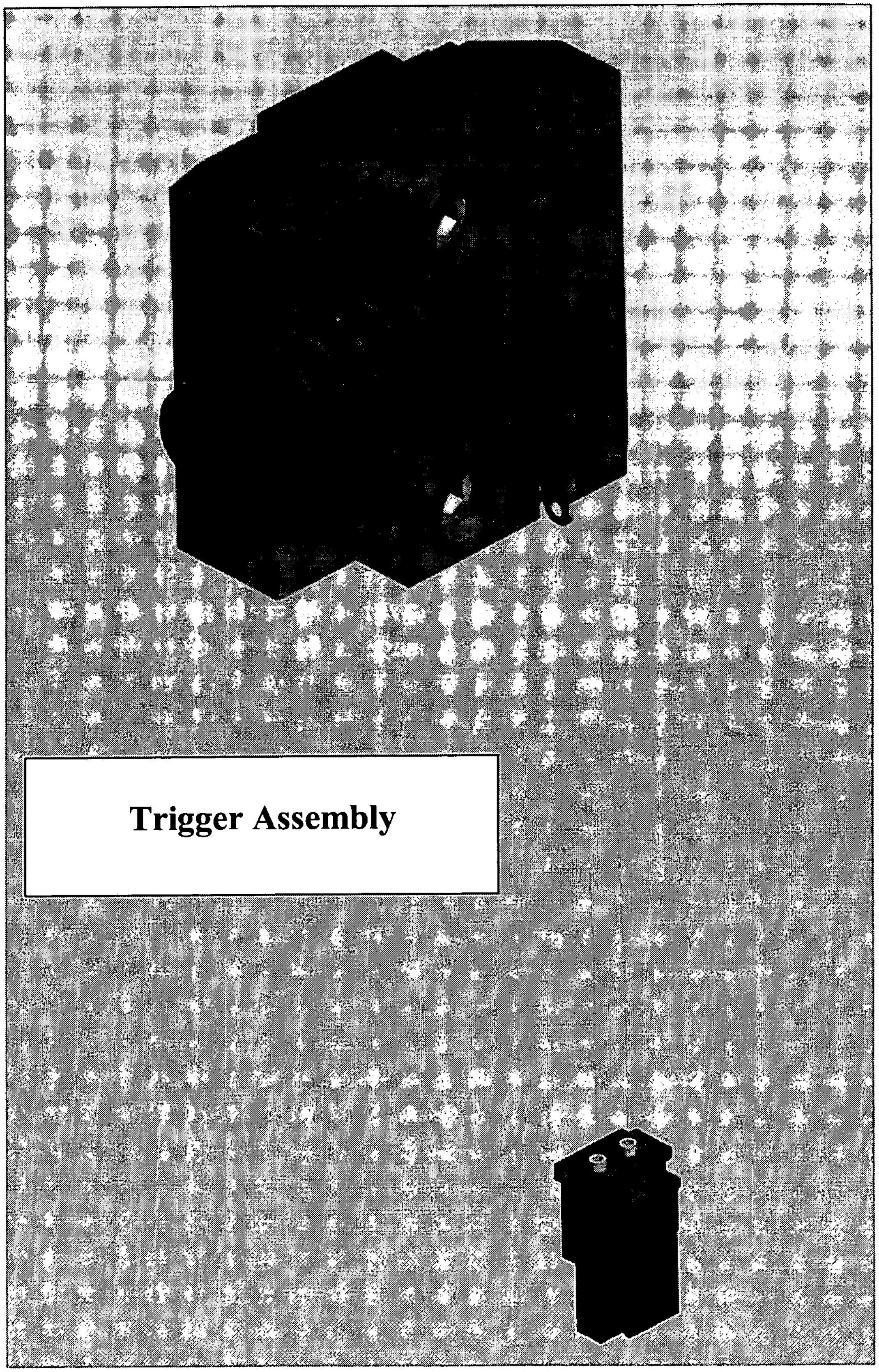


FIG. 43

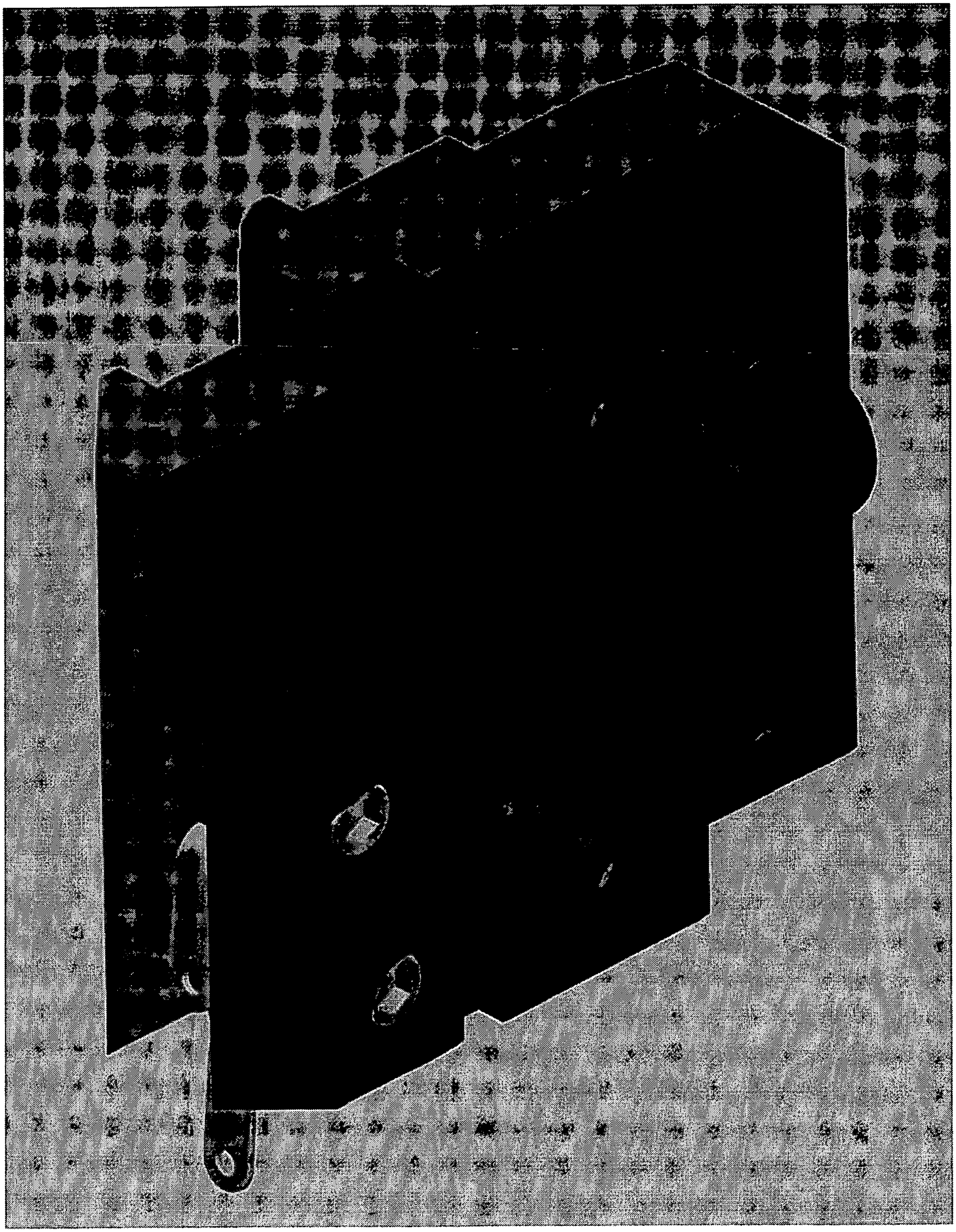


FIG. 44

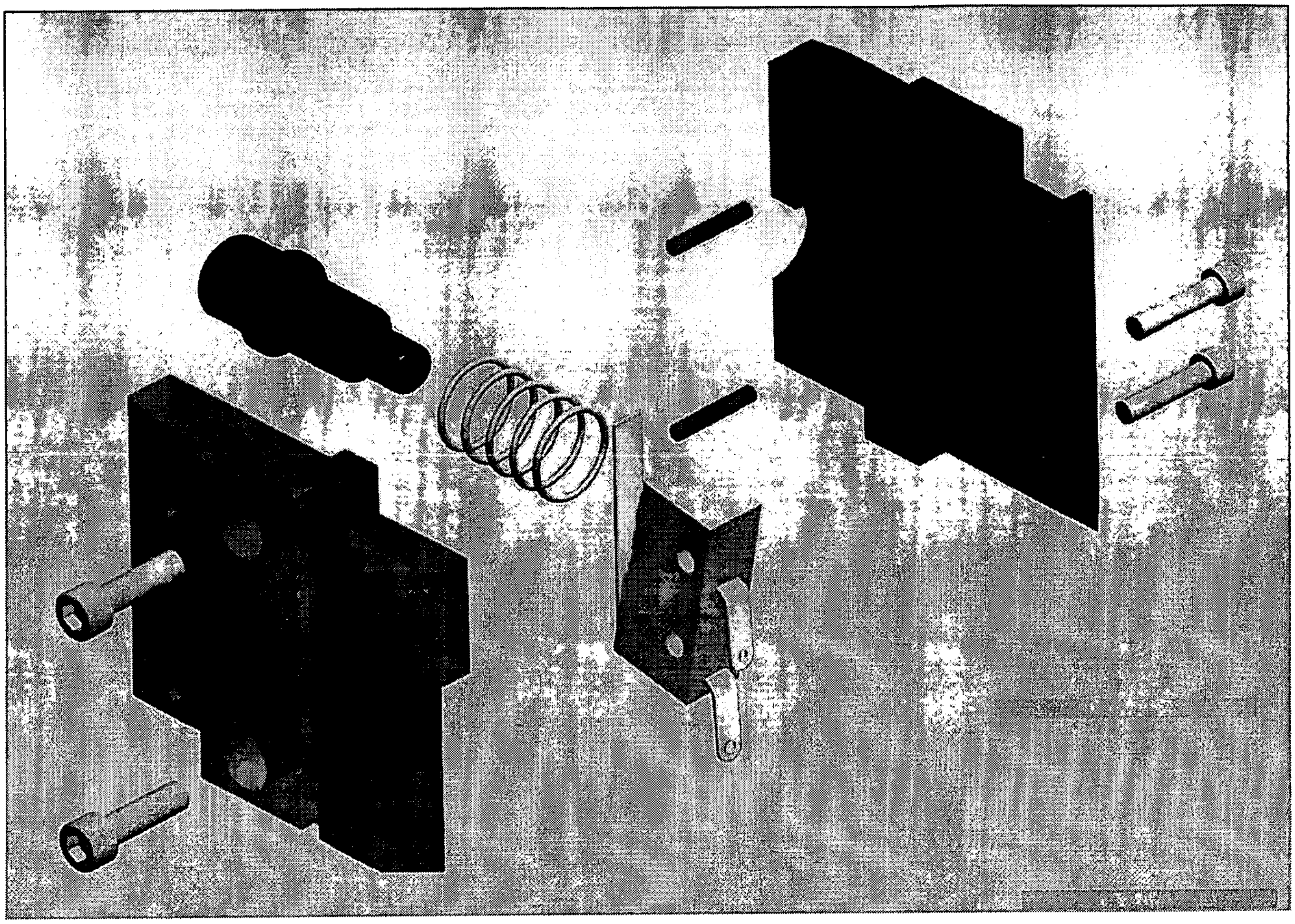


FIG. 45

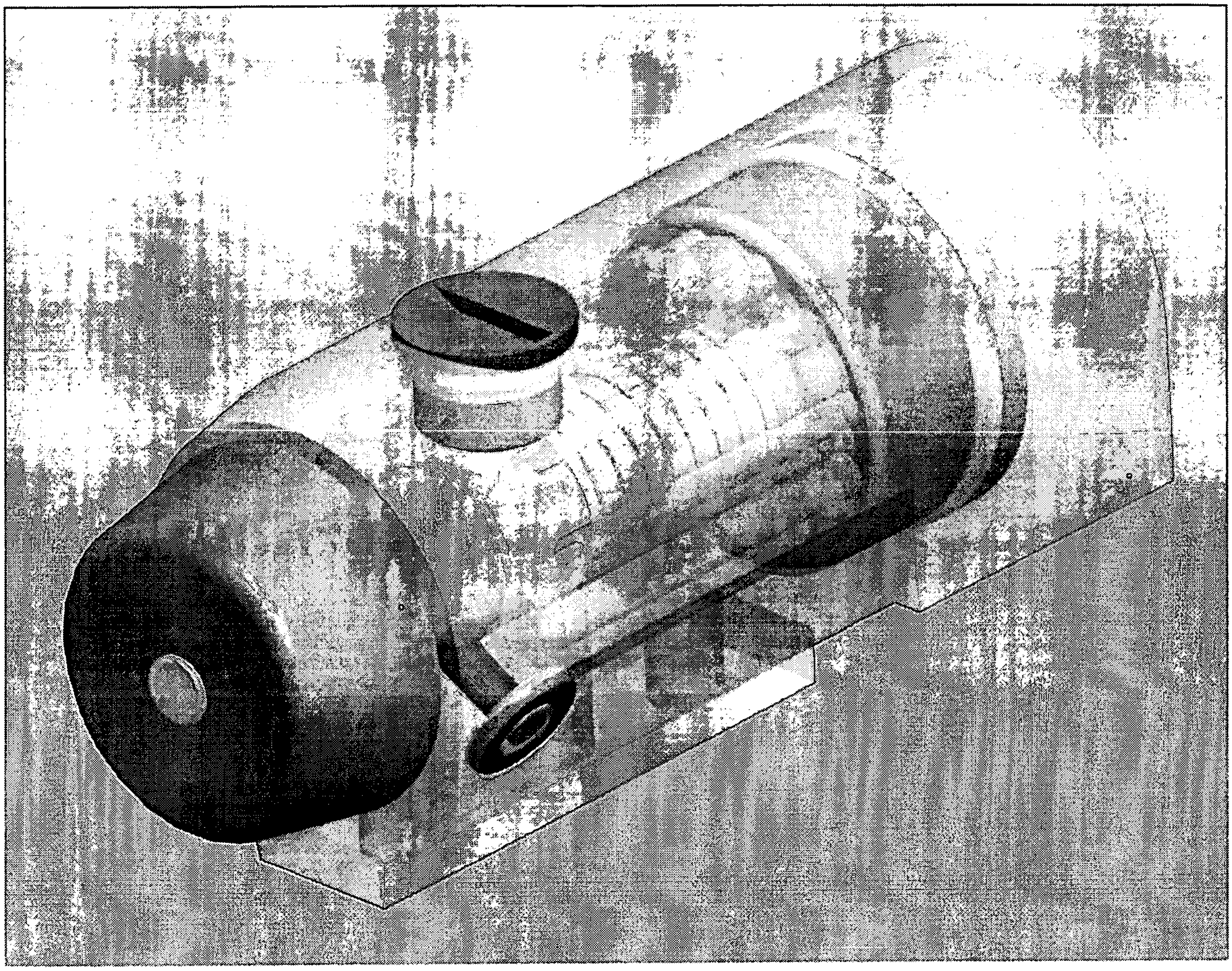


FIG. 46

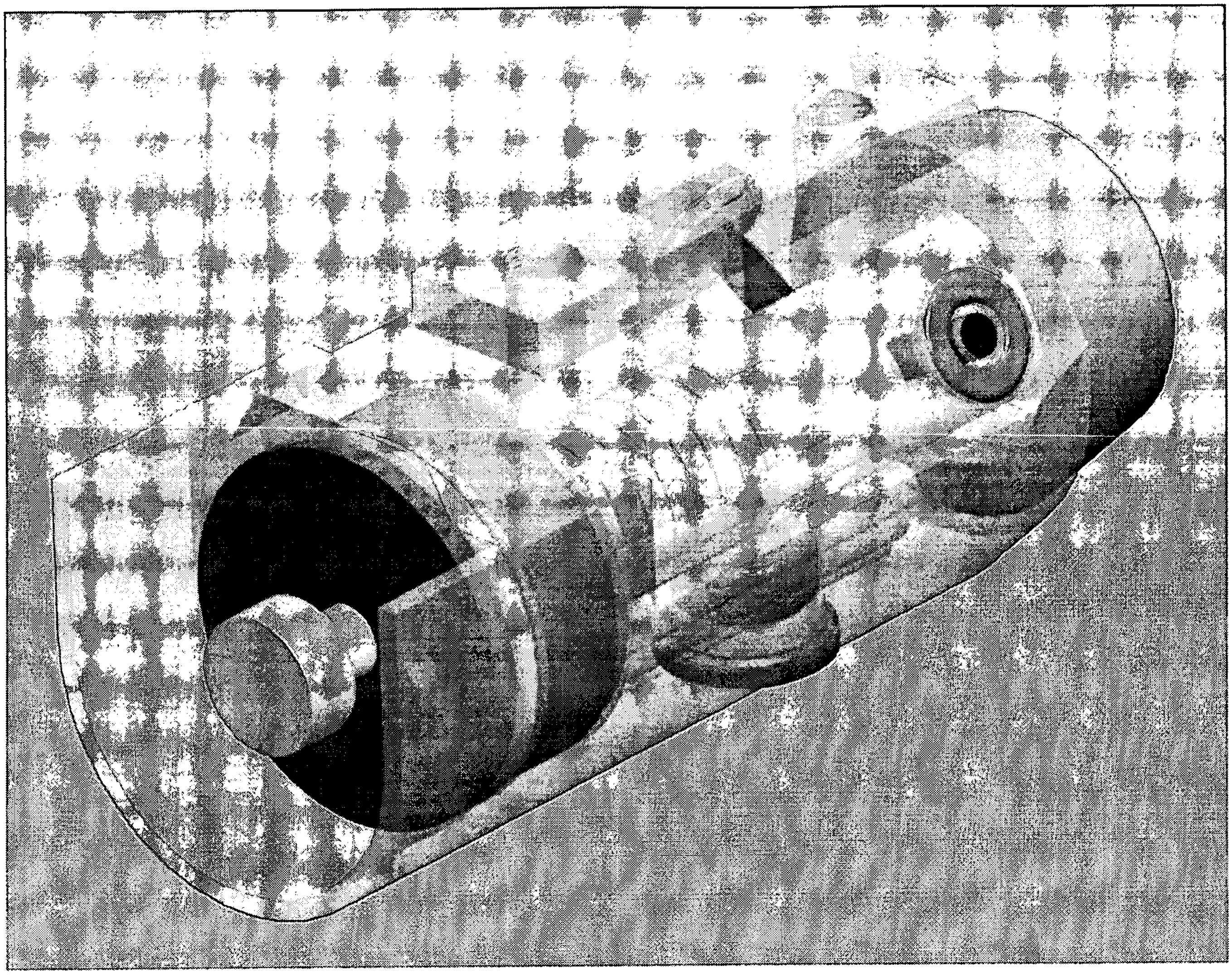


FIG. 47

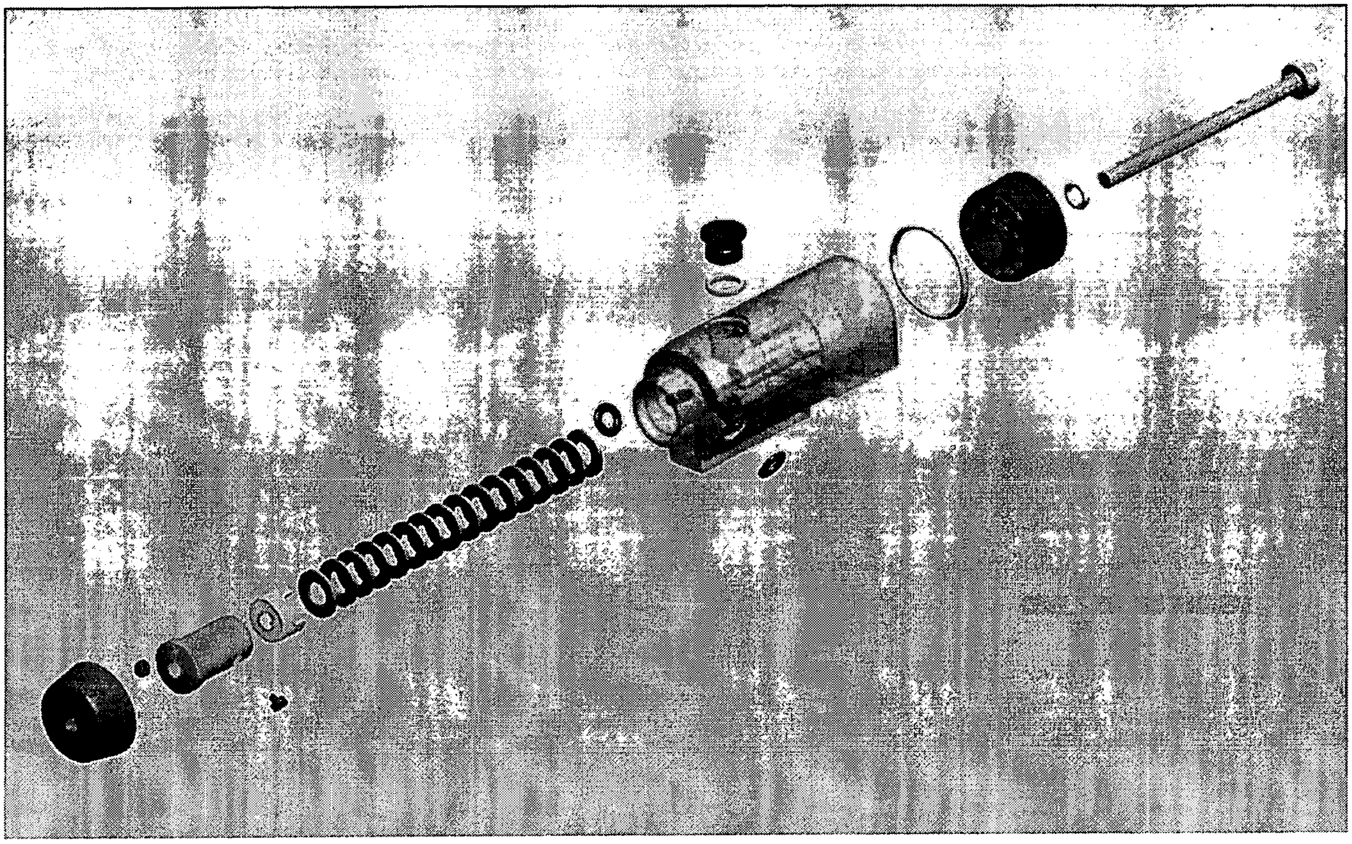
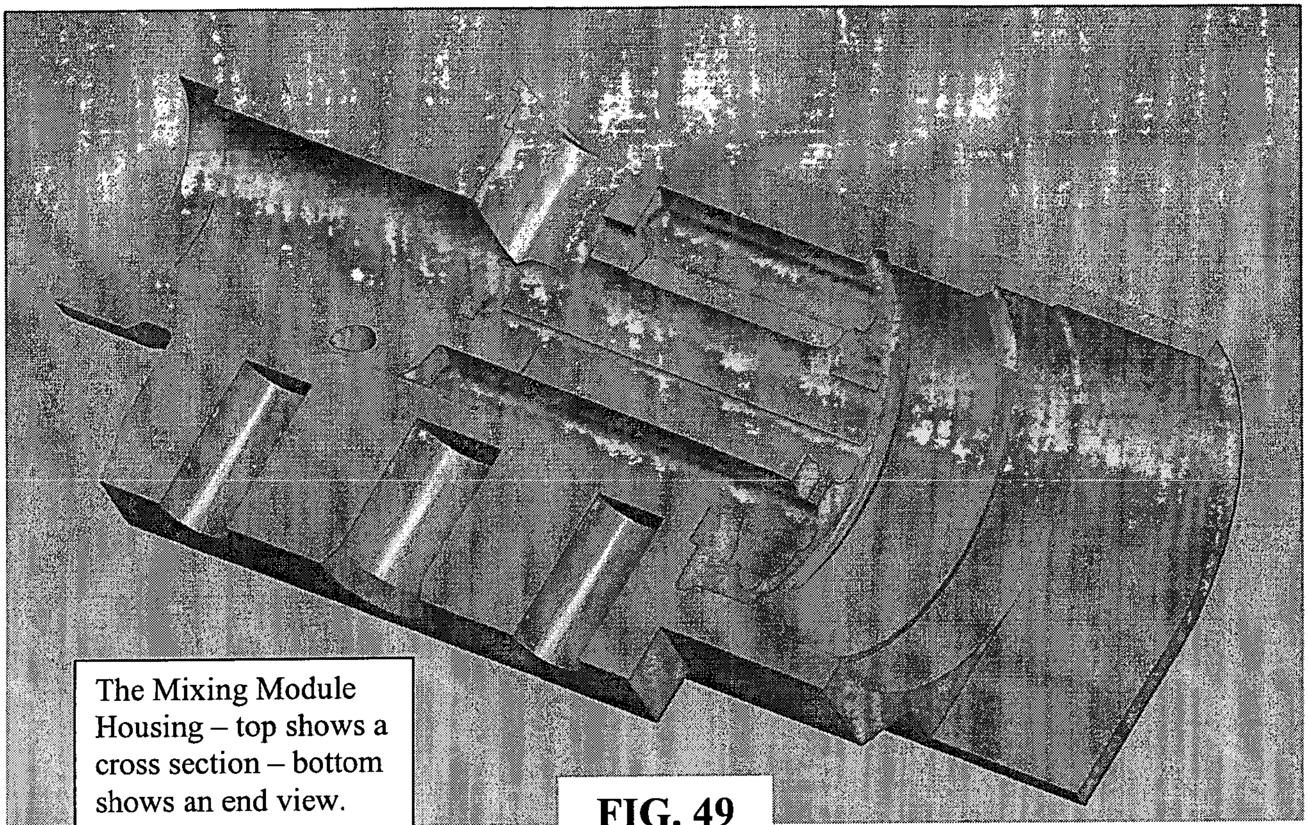


FIG. 48



The Mixing Module Housing – top shows a cross section – bottom shows an end view.

FIG. 49

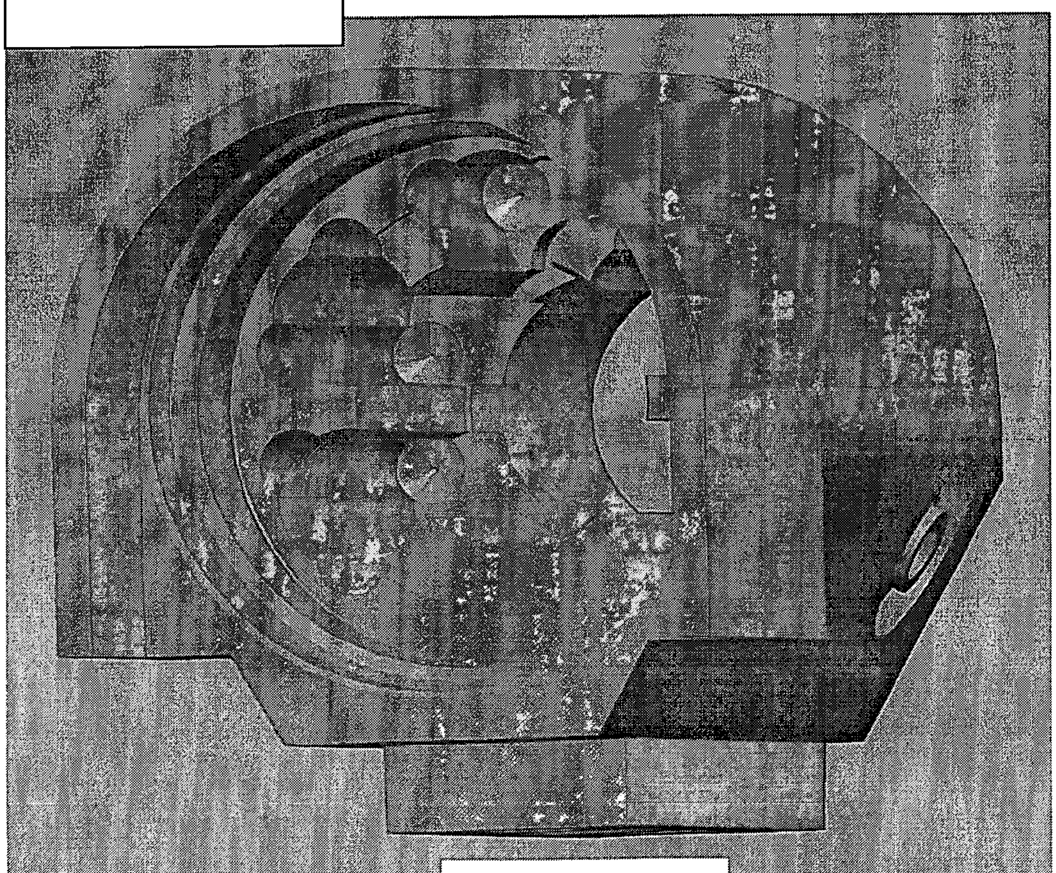


FIG. 50

Instapak® Packaging Systems

Over Twenty-Five Years of Advancement and Innovation in Foam-in-Place Packaging.

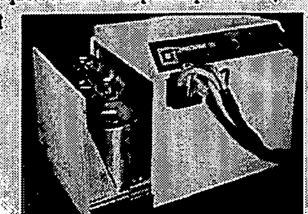
Sealed Air pioneered semi-rigid polyurethane foam technology and was the first to identify and apply its unique benefits to protective packaging. The result: the Instapak® foam-in-place packaging method. Our expertise in polyurethane foam, combined with an understanding of packaging performance and equipment design, started a 25-year tradition of advancement and innovation in foam-in-place packaging. This tradition is reflected in today's state-of-the-art Instapak® foam packaging systems.

The Technology Timeline

600 Series Systems 1969

Sealed Air introduced the first commercially viable foam-in-place packaging system, establishing the unique benefits of superior protection, just-in-time packaging, material cost reduction, space and material handling savings, and reduced freight costs.

- Pressurized five-gallon chemical containers
- External chemical heating system
- First self-cleaning dispenser



1972 Improved Self-Cleaning Dispenser

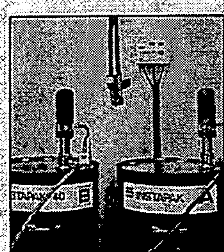
The self-cleaning dispenser concept was redesigned for longer life and ease of service.

- Accommodated chemical filter screens
- Ergonomic handle design
- Air-actuated
- Weight: 4.55 pounds

700 Series Hand-Held Systems 1976

The Instapak® 700 series systems brought the following innovations to the foam-in-place packaging process:

- Pneumatic pumps enabled the use of non-pressurized chemical containers. Now, the Instapak® foam components could be drawn out of standard 15- and 55-gallon chemical containers.
- An internal chemical heating system offered consistent chemical temperatures and better foam quality.



1982 First Cartridge Dispenser

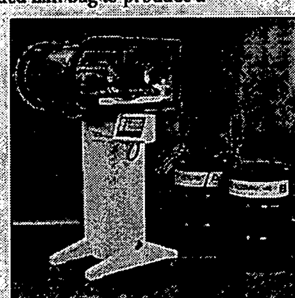
The cartridge-style dispenser design marked a major achievement in improved performance and seviceablility.

- Foam-mixing chamber could be replaced in seconds
- Built-in chemical shut-off valves and filter screens
- Weight: 2.35 pounds

Foam 'N Fill® Foam-in-Bag Packaging System 1986

This was the first machine to automatically dispense a controlled amount of Instapak® foam into a sealed film bag to produce a packaging cushion.

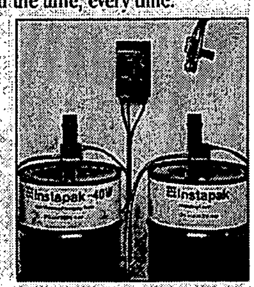
- Dispenser became machine mounted
- Produced seven cushions per minute
- Automatic control of materials use



1989 800 Series Hand-Held Systems

The Instapak® 808 system introduced the first all-electric chemical metering system that dispensed precise combinations of Instapak® foam components to ensure perfect foam all the time, every time.

- Featured self-diagnostic system controls for improved reliability and ease of service
- Controlled foam component ratio via interaction of chemical metering pumps and 808 system controls
- Included built-in timers and adjustable flow rate features



Sealed Air Corporation

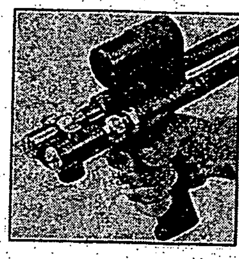
FIG. 51

Instapak® Technology Timeline

1989 — 800 Series All-Electric Dispenser

This was the first hand-held dispenser to be powered by an electric motor.

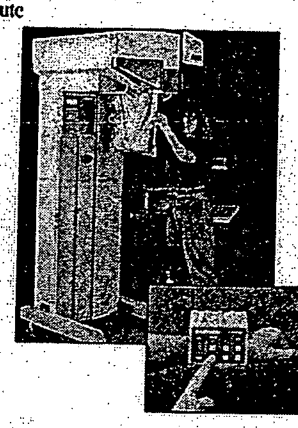
- Absolutely no compressed air required
- Improved dispenser handle ergonomics
- Weight: 3.65 pounds



1991 Instapacker™ High-Speed Foam-in-Bag Packaging System

The Instapacker™ system was the first foam-in-bag system to bring the benefits of foam packaging to the on-line distribution environment.

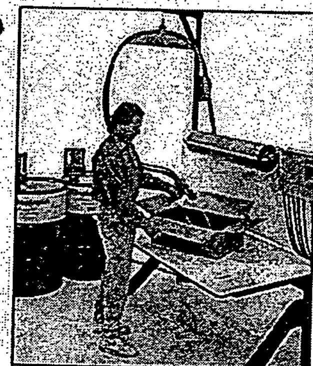
- Produces up to 24 cushions per minute
- Available with remote keypad controller



1992 — VersaPacker™ Foam-in-Bag Packaging System

The VersaPacker™ models were the first to bring foam-in-bag technology to decentralized and work-cell environments.

- Available in 19-inch floor and benchtop models, and 30-inch benchtop model. These systems work in any environment and for a wide range of products.
- The affordable VersaPacker™ system makes the benefits of foam-in-bag packaging available to more customers.
- Produces 14 foam-filled bags per minute



1994 900 Series Hand-Held Systems

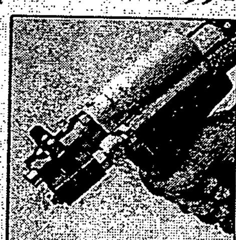
The 900 series dispensing system, designed for the global marketplace, is now the main platform for all current hand-held and foam-in-bag systems.

- Improved diagnostic and chemical metering functions
- Multilingual message center
- UL and CE safety approvals

1994 — 900 Series All-Electric Dispenser

Sealed Air's current state-of-the-art hand-held foam dispenser.

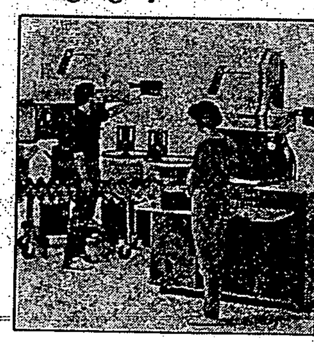
- All-electric operation
- Space-age composite construction
- Swivel fittings promote operator comfort
- Weight: 2.8 pounds



1996 SpeedyPacker™ Foam-in-Bag Packaging Systems

All new and improved, the SpeedyPacker™ systems bring foam-in-bag technology into the next century.

- Produce up to 21 foam cushions per minute
- Can be easily integrated with the Instamolder™ vertical molding table to mass-produce molded cushions
- Adjusts to process 8", 12" or 19" film widths
- UL and CE approved



Sealed Air Corporation

Engineered Products Division

10 Old Sherman Tnpk., Danbury, CT 06810 (203) 791-3500

Our Products Protect Your Products®

CORPORATE OFFICES: Park 80 East, Saddle Brook, NJ 07663

INTERNATIONAL: Australia, Brazil, Canada, England, France, Germany, Holland, Hong Kong, Italy, Japan, Korea, Malaysia, Mexico, New Zealand, Norway, Singapore, Spain, Sweden, Taiwan, Thailand

INTERNATIONAL LICENSEES AND DISTRIBUTORS: Israel, South Africa, Turkey

ENGINEERED PRODUCTS DIVISION Customer Service Locations:

CA, City of Industry, (909) 594-1791 OH, Sharonville, (513) 771-7770
CT, Danbury, (203) 791-3550 TX, Ft. Worth, (817) 540-2020
IL, Hodgkins (Chicago), (708) 352-8700 PR, Guaynabo, (809) 720-1250

ISO 9002 CERTIFIED QUALITY

DANBURY, CT

FIG. 51A

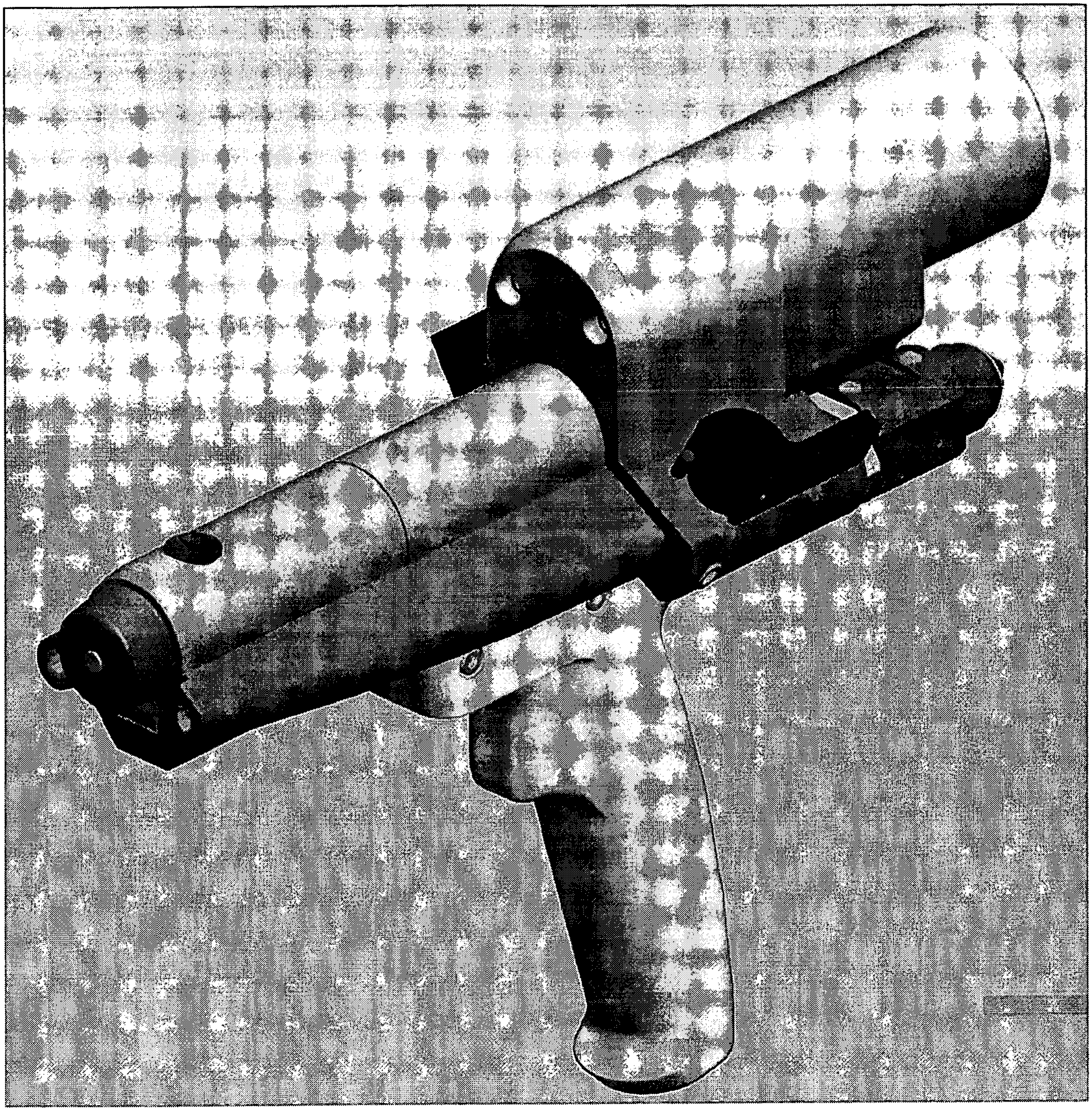


FIG. 52

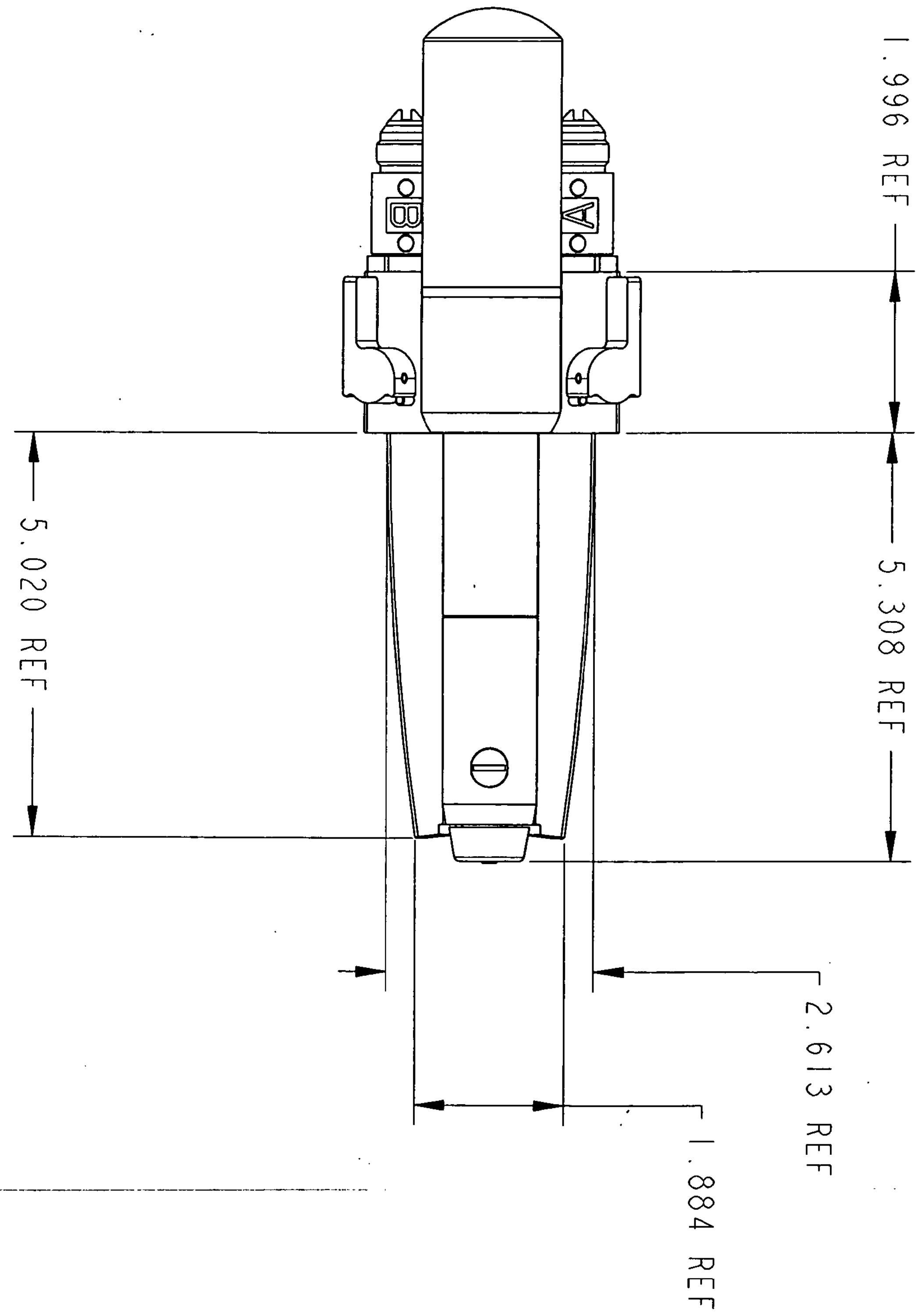


FIG. 53